HILL PUBLICATION

### REVIEWS

Dell's System 310 Sprint Amstrad and Epson laptops Mac Scanners C\_Talk

Turbo Prolog 2.0



**PRODUCT FOCUS** 

20 Affordable 80386s

# pertext

What it is—and isn't How it works How you can use it

### FIRST IMPRESSIONS

**Presentation Manager** and LAN Manager for OS/2

**New Borland Turbos:** Debugger, Pascal, C

### PLUS

Adobe Illustrator Apple's CD-ROM Drive PC power protection Super PC-Kwik/Spooler PolyBoost II

Tickler/2

Toshiba color printer



\$3.50 U.S.A./\$4.50 IN CANADA 0360-5280



# Turbo Assembler, Turbo D

What started modestly enough in November of 1983 with the launch of Borland's first program, Turbo Pascal\* 1.0, became a revolution and it's been going like a rocket ever since.

We've changed the way you program. We invented integrated environments with Turbo Pascal and we brought them to all our languages. Borland continues to bring you the best programming tools in the world.

### New! Turbo Assembler & Turbo Debugger

Two state-of-the-art development tools in one package for only \$149.95.

### New Turbo Debugger® debugs all sizes

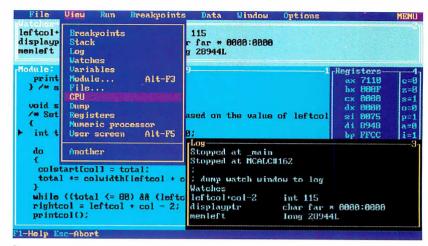
With EMS support, remote debugging, and 386 virtual machine debugging, there's no limit to the size of program you can debug. In fact with 386 virtual machine mode, debugging takes *zero*, bytes of conventional memory!

### See what's happening

Overlapping windows give you multiple views of the program you're debugging: source code, variables, CPU registers, call stack, watches, breakpoints, memory dump, and more. And a new "sessionlogging" feature tracks and records your every move.

### You're in control

Our breakpoints give you more control than anyone else's. Ordinary debuggers only get you to a stop, then they stop. When our breakpoints are triggered you can simply stop, or you can print expressions, run code, send messages to the session log, or even evaluate an expression with user-defined function calls. And *all* our breakpoints are conditional.



Shown here are views of source code, CPU registers, watch expressions, and a session log.

### Unique Data Debugging

Plain Vanilla debuggers can only give you *code* debugging. Our new Turbo Debugger give you *data* debugging too. You can browse through your data from the simplest byte to the hairiest data structure, inspect arrays, and walk through linked lists. All by point and shoot.

### Feature highlights

### **Breakpoints**

- Actions: stop, run code, log expression
- Break on condition, memory changed
- Software ICE capabilites
- **386** debug register support
- Support for hardware debuggers

### Debug any program

- Turbo Pascal, Turbo C, Turbo Assembler
- EMS support
- 386 virtual machine and remote machine debugging
- Supports CodeView® and .MAP-compatible programs

### Data Debugger

- Follow pointers through linked lists
- Browse through arrays and data structures
- Change data values

# New Turbo Assembler® lets you write the tightest, fastest code

Turbo Assembler is faster than other assemblers, and you can use it on your existing code. It's fully MASM compatible, 4.0, 5.0, and 5.1; even MASM can't say that. Turbo Assembler takes you beyond MASM, with significant new Assembly language extensions, more complete error checking, and full 386 support.

Turbo Assembler is designed for easy interfacing with high-level languages like Turbo Pascal and Turbo C. We use Turbo Assembler on Quattro,\* our best-selling spreadsheet program; now you can write your own best-seller with Turbo Assembler!

### Feature highlights

- Faster than other assemblers
- MASM compatible (4.0, 5.0, and 5.1)
- Significant new assembly language extensions
- Easy interfacing with high-level languages including Turbo C and Turbo Pascal
- Full 386 support

TURBO DEBUGGER	TURBO	
FEATURE COMPARISON	DEBUGGER	CodeView*
Multiple overlapping views	Yes	No
386 virtual-86 mode debugging	Yes	No
Remote debugging	Yes	No
Data debugging	Yes	Partial
Generalized breakpoints	Yes	No
Session logging	Yes	No
Conventional memory used—80386	Zero K	230K
Conventional memory used—remote	15K	N/A
Turbo Debugger version 1.0, Microsoft CodeView ve	ersion 2.2.	
ANNOUNCE OF THE PARTY OF THE PA		

TURBO ASSEMBLER BGIDEMO BENCHMARK Assembly time (seconds) Link time (seconds)	TURBO ASSEMBLER 9.34 4.15	Microsoft* Assembler 27.46 10.51
FEATURE COMPARISON MASM compatible (4.0, 5.0, 5.1) Thorough type checking Nested structures and unions Multimodule cross reference Assemble multiple files	Yes Yes Yes Yes Yes	No No No No
Run on IRM PS/2 model 60 using Turbo Assemb	ler version 1.0. Turbo Linker	version 2.0

Microsoft Macro Assembler version 5.10, Microsoft Overlay Linker version 3.64.

# ebugger, Turbo Pascal 5.0

# New! Turbo C° 2.0 with integrated source-level debugger

New Turbo C 2.0 is the *one* C compiler that does it all; nothing is half done or not done at all—instead, your every programming need is met. We wrote our best-selling word processor Sprint\* with Turbo C; now you can write your own best seller with Turbo C 2.0.

At better than 16,000 lines a minute,\* Turbo C 2.0 compiles your code 20-30% faster than its predecessor Turbo C 1.5 which was already faster than any other C compiler.

### Make bugs bug off

Nice bugs are dead bugs, and Turbo C 2.0's integrated source-level debugger lets you find them and flatten them in a flash. You can set multiple breakpoints, watch variables and evaluate expressions—all from inside your integrated C environment.

Minimum system requirements: For the IBM PS/2™ and the IBM® family of personal computers and all 100% compatibles. PC-DOS (MS-DOS) 2.0 or later. Turbo Debugger minumum 384K. Turbo Assembler minimum 256K. Turbo C and Turbo Pascal minimum 446K (256K comment line version).

\*Customer satisfaction is our main concern; if within 60 days of purchase this product does not perform in accordance with our claims, call our customer service department, and we will arrange a retund.

Prices and specifications subject to change without notice.

All Borland products are trademarks or registered trademarks of Borland International, Inc.
Other brand and product names are trademarks or registered trademarks of their respective holders.
Copyright © 1988 Borland International, Inc.

Status	Line( "Press wsettings( &	any key to	Indent Tab Fil	to Del Edi Rem	watch ete wa t watc ove al	teh	Ctrl-F7
	width * he	— Add Watel	/ 15; /* get	t Tog	ar all	eakpoint breakpoi breakpoi	nts
for( j	=0 ; j<10 ; ·	+j ){	/∗ For	· 10 row	s of b	oxes	*/
for (	i=0 ; i<15 .	++i ){	/∗ For	15 col	umns o	boxes	
			color++ );				
			ht );				
	+= width + 1.						
CO	lor = 1 + (ca		olors - 2));				**/
}			/* End of COLL Watch			*/	
γp,r: { c: 0	left:1, top	13, right:6	38, bottom:336	s, clip:	1.)		
4: 8							

Debugging in the Turbo environment: shown here an expression is being added to the Watch window in Turbo C. The Execution Bar highlights the next line the debugger will execute.

TURBO C 2.0		
HEAPSORT BENCHMARK	TURBO C 2.0	Microsoft® C 5.1
.OBJ size (bytes)	843	945
.EXE size (bytes)	6896	7731
Execution time (seconds)	8.1	12.2
FEATURE COMPARISON		
Integrated debugger	Yes	No*
Inline assembly	Yes	No
Auto dependency checking	Yes	No
EMS support for edit buffer	Yes	No
Device-independent graphics	Yes	No
Number of memory models	6	5
Price	\$149.95	\$450.00
Heapsort compiled with full optimization. Bench *Integrated debugger included with Quick C.	nmark run on an IBM PS/2 Mod	lel 60.

### Turbo C and Turbo Pascal owners, upgrade now! CALL (800) 543-7543

If you're a registered Turbo C and/or Turbo Pascal owner, you can upgrade and get the latest version of your favorite language, plus both Turbo Assembler and Turbo Debugger, all at special upgrade prices. Whether you order by phone or mail, be sure to include your old Turbo Pascal and/or Turbo C serial numbers and the code PL02.

Mail coupon to: Borland, Attn: Dept. PL02, 1800 Green Hills Road, P.O. Box 660005, Scotts Valley, CA 95066-0005.

**UPGRADE OFFERS** For registered Turbo Pascal\* and Turbo C\* owners! (Unregistered owners, see below\*)

Name		
Shipping address		
City (	State	Zip
Telephone		
To qualify for the upgrade price you m	nust give the serial number of the equivalent	product you are upgrading
Turbo Pascal Serial Number		

Upgrades for registered Turbo C and Turbo Pascal owners	Suggested Retail	Upgrade Price
Please check box(es)		
1  Turbo C 2.0 Professional (Includes both Turbo Assembler and Turbo Debugger)	250.00	99.95
2   Turbo Pascal 5.0 Professional (Includes both Turbo Assembler and Turbo Debugger)	250.00	99.95
3   Turbo Pascal with 5.0 upgrade manual and disks	N/A	49.95
4   Turbo C with 2.0 upgrade manual and disks	N/A	49.95
Please specify diskette size: Either □ 5¼* OR □ 3½*  Total product amount  CA and MA residents add sales tax		
In US please add \$5 shipping/handling for each product	\$ _	
In Canada please add \$10 shipping/handling for each product	\$ _	
Total amount enclosed	\$ _	
Payment: USA MC Check Bank Draft Credit card	d expiration date:	/
Card #		

Name as it appears on card

# and Turbo C 2.0!

### Turbo C 2.0 has the best of everything

- Includes the compiler, editor, and debugger, all rolled into one
- Integrated source-level debugger lets you step code, watch variables, and set breakpoints
- Develop and debug production-quality code in all six memory models
- Inline assembler support
- Support for Turbo Assembler and Turbo Debugger
- Make facility with automatic dependency checking
- Over 430 library functions, including a complete graphics library
- Only \$149.95

### New Turbo C Professional

Turbo C 2.0 plus *both* Turbo Assembler & Turbo Debugger: all three programs rolled into one—the *one* C package that has everything. A complete set of tools that caters to every level of programming expertise. Turbo C Professional: \$250. Includes coupon for free T-shirt (while supplies last).

# New! Turbo Pascal® 5.0 with integrated source-level debugger

Turbo Pascal, the worldwide favorite with over a million copies in use, just got even smarter. The best got better. Meet Version 5.0. In a word, it's revolutionary.

Not only do you go code-racing at more than 34,000 lines a minute,\* you also now go into a sophisticated debugging environment—right at source level.

Line 1098 Col 10	Indent	Eva luate	Ctr1-F4	
MoveMessage; ReadCom('Move: until Length(Comman	Board[0].Piece	— Evaluate —		
Process(Command); until Length(Command) Control := CheckMove; end; { ReadOption }	ROOK	Result		
begin ( Talk ) StartUp; FirstCall := true; NewGame(FirstCall);	queen	— New value —		
case Control of				
ReadMove : ReadOpt CheckMove : CheckOy				
•MemAvail: 116048 Board[0],r: (PIECE:ROOK; ch in ['A''Z','a''z'	COLOR: WHITE; INDEX:2	3)		

Shown here is the Evaluate/Modify window of Turbo Pascal: look at expressions, examine structured data types, change variables on the fly.

It's completely integrated and bullet-fast.

Turbo Pascal's new integrated debugger takes you inside your code for fast fixes. You step, trace, set multiple breakpoints. You modify variables as you debug and watch full expressions at runtime.

### Separate Compilation

Break your code into units. Your separately compiled units can be shared by multiple programs and linked in a flash with Turbo Pascal's built-in Make utility and smart linker. We give you a powerful library of standard units including the spectacular Borland Graphic Interface and our state-of-the-art overlay manager.

### Feature highlights

- Includes the compiler, editor, and debugger, all rolled into one
- Integrated source-level debugger lets you step code, watch variables, and set breakpoints
- Overlays, including EMS support
- 8087 floating-point emulation
- Support for Turbo Assembler and Turbo Debugger
- Procedural types, variables, and parameters
- Smaller, tighter programs: Smart Linker strips both unused code and data
- Constant expressions
- EMS support for editor
- Only \$149.95

### Debugging: The inside story

Turbo Pascal's new integrated sourcelevel debugger takes you inside your code to fix errors fast. Don't worry about errors, everyone makes them; but with the right debugger, this one, it's a fast fix.

### Turbo Pascal Professional®

Turbo Pascal 5.0 plus *both* Turbo Assembler & Turbo Debugger: all three programs rolled into one—the *one* Pascal package that has everything. A complete set of tools that caters to every level of programming expertise. Turbo Pascal Professional: \$250. Includes coupon for free T-shirt (while supplies last).

TURBO PASCAL 5.0	TURBO	Turbo
SIEVE BENCHMARK	PASCAL 5.0	Pascal 4.0
.EXE size (bytes)	1440	1504
Execution time (seconds)	6.15	7.25
FEATURE COMPARISON		
Integrated debugger	Yes	No
Overlays, including EMS support	Yes	No
8087 floating-point emulation	Yes	No
Turbo Debugger support	Yes	No
Procedural types, variables, parameters	Yes	No
Smart linking of code and data	Yes	No
Constant expressions	Yes	No
EMS support for editor	Yes	No
Benchmark (25 iterations) run on an IBM PS/2 Model 60	ı.	

# BYTE

OCTOBER 1988

VOL. 13/NO. 10

### PRODUCTS IN PERSPECTIVE

- 67 What's New
- 89 Short Takes

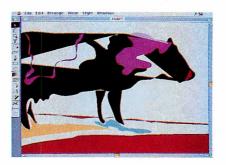
Toshiba 3-in-One P321SLC, a color dot-matrix printer Illustrator 88, PostScript drawing gets better AppleCD SC, a new CD-ROM drive Super PC-Kwik and PolyBoost II, two great caching programs Tickler/2, a powerful personal scheduler Zortech Comm Toolkit, some eye-opening programs

### **FIRST IMPRESSIONS**

- Borland Beefs Up Its Languages
   by Rick Grehan
   and Tom Thompson
   Turbo C and Turbo Pascal get
   upgrades, but the big news is
   an assembler and a debugger.
- 157 Presentation Manager and LAN Manager by Steve Apiki and Stanford Diehl A graphical interface and network support carry OS/2 well beyond the traditional DOS environment.

### REVIEWS

164 Product Focus:
80386s for the Masses
by Steve Apiki and Stanford Diehl
Twenty 80386-based clones
offering a revolutionary
feature—affordability.



Adobe Illustrator/89

### **EXPERT ADVICE**

- 101 Computing at Chaos Manor: Stick Shift or Automatic? by Jerry Pournelle Jerry takes a look at Windows and Sprint.
- 119 Applications Plus:
  Sprint with Caution
  by Ezra Shapiro
  Ezra tests Borland's new
  word processor.
- 129 Down to Business:
  Be Secure, Not Sorry
  by Wayne Rash Jr.
  Your computers and data
  need protection from
  accidents and malice.
- 133 Macinations:
  MS-DOS, MiniFans, Math,
  and Mice
  by Don Crabb
  These tools make
  the Mac a multifaceted
  machine.
- 137 OS/2 Notebook:
  The Good News
  and the Bad News
  by Mark Minasi
  There's a price to pay
  for all OS/2's features.
- 143 COM1:
  Back to the Future Again
  by Brock N. Meeks
  Prodigy may be the
  breakthrough computer
  conferencing system.

- Bucking the System
   by John Unger
   Dell's System 310 provides
   optimized performance
   at a minimized price.
- 185 The Odd Couple
  by Wayne Rash Jr.
  The Amstrad PPC640
  and the Epson Equity LT
  have little in common
  beyond portability.
- 194 Bringing the Outside World into a Macintosh by Laurence H. Loeb
  A look at five low-end scanners that bring text and graphics to the Mac.
- 201 Smalltalk à la C
  by Namir Clement Shammas
  C\_Talk provides
  powerful object extensions
  to C in a Smalltalk-like
  environment.
- 209 Turbo Prolog Revisited by Alex Lane
  Version 2.0 is a cut above the original version with enhanced database and graphics features.
- 215 D the Data Language by Pam Oppenheim An alternative to dBASE for developing custom applications.
- 223 Suit Yourself with Sprint by Lamont Wood
  A high-end word processor that you can customize.
- 230 Review Update

### IN DEPTH

### 234 Introduction: Hypertext

237 **A Grand Vision** by Janet Fiderio After 43 years, hypertext applications are coming out of research labs and into the market.

247 From Text to Hypertext by Mark Frisse Convert on-line printed documents into hierarchically structured hypertext.

255 The Right Tool for the Job by Michael L. Begeman and Jeff Conklin Hypertext offers an ideal model for the systems design process.

268 **Hyper Activity** Hypertext products, services, and information.

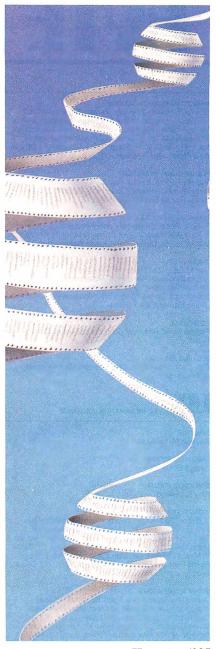
### **FEATURES**

PC Power, Part 1: **Power Protection** by Mark Waller Just what do those power protection devices do, and how well do they do it?

### HANDS ON

Ciarcia's Circuit Cellar: A Supercomputer, Part 1 by Steve Ciarcia Steve discusses the basics of multiprocessing.

293 **Some Assembly Required:** Floating-Point without a Coprocessor, Part 2 by Rick Grehan Getting numbers to and from a binary floating-point mathematics package.



Hypertext/235

### DEPARTMENTS

- Editorial: The Russians Are Coming
- 11 Microbytes
- 22 Letters
- 33 Chaos Manor Mail
- 38 Ask BYTE
- 50 **Book Reviews**
- 339 Coming Up in BYTE

### READER SERVICE

- Editorial Index by Company
- 340 Alphabetical Index to Advertisers
- 342 Index to Advertisers by Product Category Inquiry Reply Cards: after 344

### PROGRAM LISTINGS

From BIX: see 232 From BYTEnet: call (617) 861-9764 On disk or in print: see card after 312



PC Power Protection/270

BYTE (ISSN 0360-5280) is published monthly with an additional issue in October by McGraw-Hill Inc. Postmaster: Send address changes, USPS Form 3579, undeliverable copies, and fulfillment questions to BYTE subscriptions, P.O. Box 7643, Teaneck, NI 07666-9866. Second-class postage paid at Peterborough, NH 03458 and additional mailing offices. Postage paid at Winnipeg, Manitoba. Registration number 9321. Printed in the United States of America. Not responsible for lost manuscripts or photos. Opinions expressed by the authors are not necessarily those of BYTE. Copyright © 1988 by McGraw-Hill Inc. All rights reserved. Trademark registered in the United States Patent and Trademark Office.



Subscription questions or problems should be addressed to: BYTE Subscriber Service, P.O. Box 7643, Teaneck, NJ 07666-9866



EDITOR IN CHIEF Frederic S. Langa

OPERATIONS

Glenn Hartwig Associate Managing Editor

REVIEWS (Hardware, Software, Product Focus)
Cathryn Baskin Associate Managing Editor, Dennis Allen
Senior Technical Editor, Software, Stephen Apiki Testing
Editor, BYTE Lab, Stanford Diehl Testing Editor, BYTE Lab

NEWS AND TECHNOLOGY (Microbytes, What's New, Short Takes) Rich Malloy Associate Managing Editor, D. Barker Senior Editor, News and Technology, Anne Fischer Lent Senior Editor, New Products

Peterborough: Roger Adams Associate News Editor, David Andrews Associate News Editor, Martha Hicks Associate News Editor
West Coast: Gene Smarte Bureau Chief, Costa Mesa,

Nicholas Baran Technical Editor, San Francisco, Frank Hayes Associate News Editor, Marlene Nesary Associate News Editor, Jeffrey Bertolucci Editorial Assistant, San Francisco

SENIOR TECHNICAL EDITORS
Ken Sheldon Features, Jane Morrill Tazelaar In Depth, Richard Grehan At Large, Tom Thompson At Large

TECHNICAL EDITORS
Janet J. Barron, Janet Fiderio, Jon Udell, Stanley Wszola

ASSOCIATE TECHNICAL EDITOR Robert Mitchell

CONSULTING EDITORS Steve Ciarcia, Jerry Pournelle, Ezra Shapiro, Don Crabb, Brock N. Meeks, Mark Minasi, Wayne Rash Jr.

CONTRIBUTING EDITORS
Jonathan Amsterdam Programming Projects, Mark
Dahmke Video, Operating Systems, Mark Haas At Large,
Rik Jadrnicek CAD, Graphics, Spreadsheets, Robert T.
Kurosaka Mathematical Recreations, Alastair J. W. Mayer Nordisak Mainterlatical necreatoris, Nassati J. W. Mayer Software, Stan Miastkowski New Technology, Alan R. Miller Languages and Engineering, Dick Pountain Algorithms, Roger Powell Computers and Music, Phillip Robinson Semiconductors, Jon Shiell High-Performance Systems, Ernest Tello Artificial Intelligence

COPY EDITORS Lauren Stickler *Chief*, Susan Colwell, Judy Connors-Tenney, Jeff Edmonds, Nancy Hayes, Cathy Kingery, Margaret A. Richard, Warren Williamson

**EDITORIAL ASSISTANTS** 

Peggy Dunham *Office Manager*, Linda C. Ryan, June N. Sheldon, Lynn Susan Valley

ART Nancy Rice Director, Joseph A. Gallagher Assistant Director, Jan Muller Assistant, Alan Easton Technical Artist

David R. Anderson *Director*, Virginia Reardon
Senior Editorial Production Coordinator, Denise Chartrand
Editorial Production Coordinator, Michael J. Lonsky Editorial Production Coordinator

TYPOGRAPHY Sherry Fiske *Systems Manager*, Donna Sweeney *Applications Manager*, Christa Patterson

ADVERTISING/PRODUCTION (603) 924-6448

ADVENTISING/PHODUCTION (1953) 1924-1948
Lisa Wozmak Director, Lyda Clark Senior Account
Coordinator, Karen Cilley, Linda Fluhr, Jeanne Gatcombe,
Brian Higgins, Rod Holden, Wai Chiu Li Quality Control
Manager, Julie Murphree Advertising/Production
Coordinator

MARKETING COMMUNICATIONS

MARKETING COMMUNICATIONS Horace T. Howland Director, Pamela Petrakos-Wilson Promotion Manager, Wilbur S. Watson Marketing Services Manager, Dawn Matthews Public Relations Manager, Lisa Jo Steiner Marketing Assistant, Stephanie Warnesky Marketing Art Director, Sharon Price Associate Art Director, Julie Perron Market Research Analyst

PLANNING AND RESEARCH Michele Perron Director Faith Kluntz Copyrights Coordinator, Cynthia Damato Sands Reader Service Coordinator

FINANCIAL SERVICES

Philip L. Penny Director of Finance and Services, Kenneth A. King Business Manager, Christine Monkton Assistant, Marilyn Haigh, Diane Henry, JoAnn Walter, Jaime Huber

CIRCULATION

Dan McLaughlin Director

James Bingham Newsstand Sales Manager, Vicki Weston
Assistant Manager, Karen Desroches Distribution
Coordinator, Donna Healy, Direct Accounts Coordinator, Louise Menegus Back Issues

PERSONNEL
Patricia Burke Personnel Coordinator, Beverly Goss

BUILDING SERVICES
Tony Bennett Manager, Cliff Monkton, Mark Monkton,

BIX BYTE INFORMATION EXCHANGE

DIRECTOR Stephen M. Laliberte

EXECUTIVE EDITOR George Bond

ASSOCIATE EDITOR Tony Lockwood

MICROBYTES DAILY

Reed Lexington, KY

**GROUP MODERATORS** 

GROUP MODERATORS
David Allen Applications, Frank Boosman Artificial
Intelligence, Leroy Casterline Other, Marc Greenfield
Programming Languages, Jim Howard Graphics, Gary
Kendall Operating Systems, Steve Krenek Computers,
Brock N. Meels Telecommunications, Barry Nance New
Technology, Donald Osgood Computers, Sue Rosenberg
Other, Jon Swanson Chips

BUSINESS AND MARKETING Patricia Bausum Secretary, Denise A. Greene Customer Service, Brian Warnock Customer Service, Tammy Burgess Customer Credit and Billing

**TECHNOLOGY** 

Clayton Lisle Director, Business Systems Technology, MHIS, Jack Reilly Senior Business Systems Analyst, Bob Dorobis Business Systems Analyst, Fred Strauss Senior Business Systems Analyst

PUBLISHER/GROUP VICE PRESIDENT J. Burt Totaro

ADVERTISING SALES

Dennis J. Riley Director, (603) 924-9281 Sandra Foster Administrative Assistant

NEW ENGLAND ME, NH, VT, MA, RI, ONTARIO, CANADA & EASTERN CANADA John C. Moon (617) 262-1160

ATLANTIC NY, NYC, CT, NJ (NORTH) Leah G. Rabinowitz (212) 512-2096 (203) 968-7111

PA, KY, NJ (SOUTH), MD, VA, W.VA, (215) 496-3833

SOUTHEAST

NC, SC, GA, FL, AL, TN Thomas Tolbert (404) 252-0626

MIDWEST

IL, MO, KS, IA, ND, SD, MN, WI, NE, IN, MI, MS, OH Bob Denmead (312) 751-3740

Jennifer L. Bartel West Coast Sales Manager, (214) 644-1111

SOUTHWEST, ROCKY MOUNTAIN CO, WY, OK, TX, AR, LA Karl Heinrich (713) 462-0757

SOUTH PACIFIC SOUTHERN CA, AZ, NM, LAS VEGAS Jack Anderson (714) 557-6292 Tom Harvey (213) 480-5243

NORTH PACIFIC HI, WA, OR, ID, MT, NORTHERN CA, NV (except LAS VEGAS), UT, WESTERN CANADA Mike Kisseberth (415) 362-4600

Bill McAfee (415) 349-4100 TELEMARKETING

L. Bradley Browne Director Susan Boyd Administrative Assistant

BYTE BITS (2x3) Dan Harper (603) 924-6830

THE BUYER'S MART (1x2) Mark Stone (603) 924-3754

REGIONAL ADVERTISING SECTIONS MID-ATLANTIC, METRO NY & NEW ENGLAND, SOUTHERN CALIFORNIA Elisa Lister (603) 924-6830

MIDWEST, PACIFIC NORTHWEST, METRO NY & NEW ENGLAND Scott Gagnon (603) 924-6830

SOUTHEAST, SOUTHWEST Denise Vernier (603) 924-9281

BYTE DECK MAILINGS National Ed Ware (603) 924-6166

A/E/C COMPUTING DECK
COMPUTING FOR ENGINEERS DECK Mary Ann Goulding (603) 924-9281

INTERNATIONAL ADVERTISING SALES STAFF See listing on page 341.

**EDITORIAL AND BUSINESS OFFICE:** 

Cone Phoenix Mill Lane, Peterborough, NH 03458, (603) 924-9281.

West Coast Branch Offices: 425 Battery St., San Francisco, CA 94111, (415) 954-9718; 3001
Red Hill Ave., Building #1, Suite 222, Costa Mesa, CA 92626, (714) 557-6292.

New York Branch Editorial Office: 1221 Avenue of the Americas, New York, NY 10020, (212)

BYTEnet: (617) 861-9764 (set modern at 8-1-N or 7-1-E; 300 or 1200 baud). Fax: (603) 924-7507. Telex: (603) 924-7861. SUBSCRIPTION CUSTOMER SERVICE: Outside U.S. (201) 837-1315; Inside U.S. (800) 423-8272.

Officers of McGraw-Hill Information Services Company: President: Walter D. Serwatka. Executive Vice Presidents: Kenneth E. Gazzola, Aerospace and Defense; Ira Herenstein, Computers and Communications; Russell C. White, Construction; Robert P. McGraw, Healthcare; Brian H. Hall, Legal. Senior Vice Presidents-Publishers: Laurence Attman, Data Communications; David J. McGrath, Engineering News-Record. Senior Vice Presidents: Robert D. Daleo, Finance; Michael J. Koeller, Human Resources, Group Vice Presidents: Alur Totare, BYTE; Norbert Schumacher, Energy/Process Industries. Vice Presidents: George Elsinger, Circulation; Julia Lenard, Systems Planning and Technology. Officers of McGraw-Hill, Inc.: Joseph L. Dionne, Chairman, President, and Chief Executive Officer; Robert N. Landes, Executive Vice President, General Counsel, and Secretary; Robert J. Bahash, Executive Vice President and Chief Financial Officer; Frank D. Penglase, Senior Vice President, Treasury Operations.

Founder: James H. McGraw (1860–1948). Executive, editorial, circulation, and advertising offices: One Phoenix Mill Lane, Peterborough, NH 03458, phone (603) 924-9281. Office hours: Monday through Thursday 8:30 AM-4:30 PM, Priday 8:30 AM-1:00 PM, Eastern Time. Address subscriptions to BYTE Subscriptions, P.O. Box 7643, Teaneck, NJ 07666-9866. Subscriptions are \$22.95 for one year, \$39.95 for two years, and \$55.95 for three years in the U.S. and the Spossessions. In Canada and Mexico, \$25.95 for one year, \$44.95 for two years, \$64.95 for three years, \$75 for one-year air delivery to Europe. Y28,800 for one-year air delivery to Japan, Y14,400 for one-year surface delivery to Japan, \$75 for one-year air delivery to Europe. Y28,800 for one-year air delivery to Japan, \$14.400 for one-year surface delivery of first sizes should be remitted in U.S. funds drawn on a U.S. bank. Please allow six to eight weeks for delivery of first sizes should be remitted in U.S. funds drawn on a U.S. bank. Please allow six to eight weeks for delivery of first sizes should be remitted in U.S. funds drawn on a U.S. bank. Please allow six to eight weeks for delivery of first sizes of the property of the structure of the property of the WC1R 4EJ, England.

BYTE and BYTE are registered trademarks of McGraw-Hill, Inc.

# Integrated Software for Schematics & PCB Artwork



### Introducing HiWIRE Plus

Wintek's smARTWORK® pioneered low-cost printedcircuit-board CAD. Then HiWIRE set the standard for productivity and ease-of-use in schematic capture. Now Wintek introduces HiWIRE-Plus, integrating HiWIRE's schematic features with a powerful printed-circuitdesign facility.

### **Creating Schematics**

With HiWIRE-Plus, simply connect library symbols with wires and buses. Creating and changing symbols is fast and painless. Produce your drawing using a dot-matrix printer, laser printer, or pen plotter.

### Circuit-Board Design

HiWIRE-Plus gives you all the design freedom you want: you choose the grid size, trace widths, and pad shapes. The board size and number of lavers are virtually unlimited. HiWIRE-Plus is perfect for surface-mount, microstrip, and ECL applications.

**CURRENT VERSIONS** 

### **HiWIRE-Plus Advantages**

- □ One tool for schematics and printed-circuit artwork
- ☐ Easy-to-learn menu-driven operation; complete documentation and tutorial
- ☐ Schematic libraries with TTL. CMOS, ECL, ladder, microprocessor, and discrete components
- ☐ Netlist and bill-of-materials utilities included
- ☐ Circuit boards up to 60x60 inches and 256 layers
- ☐ Variable grid size, trace width, and pad size (.001" resolution)
- ☐ PCB library with DIPs. SIPs. SMDs, PGAs, TOs, and edge and D connectors
- ☐ Schematic-to-layout crosschecking
- □ Design-rule checker
- □ 800 number for free support



"HiWIRE", "srnARTWORK", "Wintek", and the Wintek logo are registered trademarks of Wintek Corporation.

### **System Requirements**

- ☐ IBM PC, XT, AT, or PS/2 with 512K RAM, printer port, color monitor, and CGA, EGA, or VGA graphics card
- ☐ Microsoft Mouse
- ☐ IBM ProPrinter or Epson dot-matrix printer, and/or
- ☐ Houston Instrument or Hewlett-Packard pen plotter

### **Higher Performance Better Value**

Still only \$895, HiWIRE-Plus delivers quality schematics and PCB artwork. You don't need to guess if HiWIRE-Plus is right for you-we guarantee it! Try it for 30 days at absolutely no risk. Call toll free today and put HiWIRE-Plus to work for you.

### Wintek Corporation

1801 South Street Lafayette, Indiana 47904-2993 (800) 742-6809 or (317) 742-8428

FAX: (317) 448-4823 Telex: 70-9079

Europe: RIVA Ltd., England, Phone: 0420 22666, FAX: 0420 23700 Australia: Entertainment Audio Pty, Ltd., Phone: (08) 363-0454

# THE RUSSIANS ARE COMING

And they're looking to do business with some very interesting software

n a steamy Friday in New York late last summer, some members of BYTE's staff met with a group of senior Soviet computer scientists. The purpose was to learn about the state of the art in Russian computer technology and to see demonstrations of IBM PC AT-based software that they hope to export to the West.

Almost the entire Soviet delegation was made up of members of the USSR Academy of Sciences. Attendees included Boris Batalov, head of the Scientific Research Institute; Lev Bogdanov, chief of the Department of Applied Physics and Mathematical Sciences for the Presidium; Vadim Kotov, deputy director of the Siberian Computer Center; and Alexander Vasenkov, head of the State Committee for Computer Technology.

Their software demonstration is a selfrunning "film" (their word)-sort of a Dan Bricklin-like demonstration: a fastmoving, sound-and-color canned presentation of mock-up screens that are meant to reflect the actual product. Lots of colored windows pop up everywhere, with native Russian explanations of what's going on translated (and, sometimes, confusingly transliterated) into English. In all, it's very interesting.

The demonstration includes a powerful equation solver; a simpler, for-fun program for solving mathematical puzzles; a database you can query in natural language to find out (using their examples) when Good Night, Little Ones is playing on State TV; a time planner/project management package (interestingly, they call it "plan" management); a macroeconomics modeler (their demonstration actually models the Russian State economy through the year 2000); and lots of information on the expert-system technology they used to construct these programs from "modules."

Vadim Kotov, who did most of the talking for the group, stressed that their system was not just a set of tools, but a "factory" of interconnected applications that can be used to create complex programs in a very short time.

It all looks very flexible and modular; it's written in a powerful hybrid of Prolog and Smalltalk-sort of an objectoriented Prolog.

The whole demonstation is clever, flashy, and unabashedly commercialthey're looking for American companies to market their "software factory" technology. (And vice versa: DataEase International set up their visit to the United States and as a result will be selling a database program in Russia.)

Because the demonstration software gives a glimpse into a heretofore largely unknown portion of the microcomputing community, we'll make the program available in the listings area of BIX so you can see it for yourself: Look for RUSSIAN1.ARC, RUSSIAN2.ARC, and RUSSIAN3.ARC in the FromBYTE area. You'll need a computer with EGA to see all the demonstration, although some parts of it will work on monochrome systems.

We also saw another program separately demonstrated: Lexikon is a Russian word processor similar to WordStar but not a clone. Kotov said he was particularly proud of the thesaurus included with this product; Russian uses a number of declensions, so a thesaurus has to be clever to work well.

Kotov's group has been busy. For example, it designed the typesetting system for Pravda (with a circulation of 10 million, it's one of the world's largest publications). The Pravda system uses multiprocessing, and it has a "flat" structure (i.e., one layer of modules rather than a hierarchy of modules and submodules).

Kotov's group also recently designed the first Soviet 32-bit microcomputer: It looks more like a PDP-1140 than a desktop system. At its heart is a basic multiprocessing chip with reduced-instruction-set-computer-like architecture. The processor is "something like a Transputer," but they do not use Occam, the multiprocessing programming language developed for the Transputer by INMOS. Nor do they use the asynchronous communication bus developed by INMOS. Instead, they use a FIFO synchronous channel.

By coincidence, we had brought along a Definicon two-Transputer board to show them; the chips occupied barely half of one AT-style card. Kotov said the equivalent Soviet silicon and support circuitry would fill a volume about half that of an entire AT system.

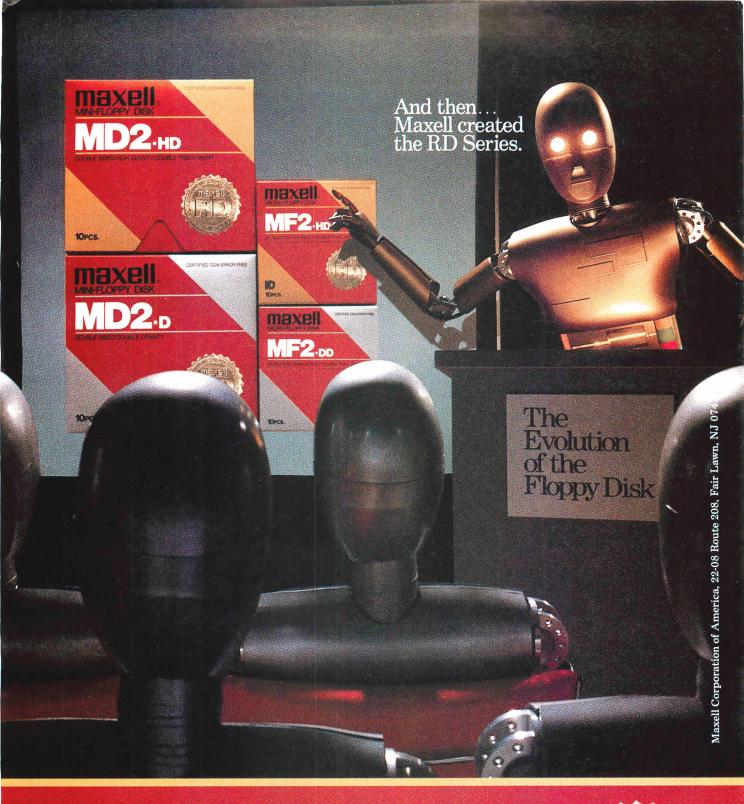
One of the Russians mentioned that there were 200,000 personal computers in the Soviet Union, most of them Russian-made clones of the IBM PC and AT. They would like to buy or build 80386based systems, but the most advanced chip that can be legally sold to them is an 80286 running at 12.5 MHz or slower.

The most popular programming language in the Soviet Union is C, followed by Pascal and Modula-2. The Soviets use primarily under the Unix operating system.

Most computers are in offices, but a small number of programmers are able to take their computers home to work there.

Because of a shortage of Western currency, most Soviet institutions get only one copy of BYTE, which goes in the library. When the issue arrives, Kotov says, a line of people forms to sign up to read it. Kotov says he and his colleagues refer to the magazine as "PlayBYTE, because it has so many interesting things to look at."

> -Fred Langa Editor in Chief (BIX name "flanga")



Never before has this level of Reliability and Durability been available in floppy disks. Introducing the new RD Series from Maxell. Twice the durability of the disks you're now using. Twice the resistance to dust and dirt.

And the RD Series is ten times more reliable than conventional floppy disks.

The Gold Standard has always meant maximum safety for your data. Now it means even more.







### WINDOWS FOR DATA®

MULTI-LEVEL
MENU SYSTEM
NESTED FORMS
POP-UP FORMS
REGION
CHOICE LIST

Search for custo Enter customer i Enter billing ad	008784 I	MD: N MD: N MD: N	37/87 Customer— William Jo Innovative 351 Bullet Needham, M (617) 394-	ones e Softwar in Avenu IA 0219	e e	
No. PRODUCT	DESCRIPTI	ON	QUANTITY	PRICE	AMOUNT	7 -
5 WDMS W	indows for Data	Microsoft	10	295.00	2950.00	
	indows for Data		5		1475.00	B
	indows for Data					T.
8 MDXE M	indows for Data	XENIX	2	795.00		
9			0	0.00	0.00	
MDXE Windo	ws for Data - XE	NIX	Subto	tal:	11325.00	
A STATE OF THE PARTY OF THE PAR	ws for Data - 3E ws for Data - Su	the state of the s	Shipp	ing:	0.00	
THE PERSON NAMED IN COMPANY OF	ws for Data - Mi	Management of the second second	TOTAL		11325.00	E
WDVM4 Windo	ws for Data - Va	× 780	Payme		0.00	

CLOCK

POP-UP
WINDOW

RUNNING

TOTALS

MESSAGE
WINDOW

If you program in C, take a few moments to learn how Windows for Data can help you build a state-of-theart user interface.

- ☑ Create and manage menus, data-entry forms, contextsensitive help, and text displays — all within windows.
- ▼ Develop window-based OS/2 programs right now, without the headaches of learning OS/2 screen management. Run the same source code in PCDOS and OS/2 protected mode.
- Build a better front end for any DBMS that has a Clanguage interface (most popular ones do).



### FROM END TO BEGINNING

Windows for Data begins where other screen packages end, with special features like nested pop-up forms and menus, field entry from lists of choices, scrollable regions for the entry of variable numbers of line items, and an exclusive built-in debugging system.

### NO WALLS

If you've been frustrated by the limitations of other screen utilities, don't be discouraged. You won't run into walls with Windows for Data. Our customers repeatedly tell us how they've used our system in ways we never imagined — but which we anticipated by designing Windows for Data for unprecedented adapatability. You will be amazed at what you can do with Windows for Data.

### YOU ARE ALWAYS IN CHARGE

Control functions that you write and attach to fields and/or keys can read, compare, validate, and change the data values in all fields of the form. Upon entry or exit from any field, control functions can call up subsidiary forms and menus, change the active field, exit or abort the form, perform almost any task you can imagine.



### OUR WINDOWS WILL OPEN DOORS

Our windows will open doors to new markets for your software. High-performance, source-codecompatible versions of Windows for Data are now available for PCDOS, OS/2, XENIX, UNIX, and VMS. PCDOS

versions are fully compatible with Microsoft Windows. **No royalties**.

### MONEY BACK GUARANTEE

You owe it to yourself and your programs to try Windows for Data. If not satisfied, you can return it for a full refund

Prices: PCDOS \$295, Source \$295. OS/2 \$395. XENIX \$795. UNIX, VMS, please call.

Call: (802) 848-7731

ext. 51

Telex: 510-601-4160 VCSOFT

FAX 802-848-3502



21 Elm Ave. Richford, VT 05476

### **MICROBYTES**

Staff-written highlights of developments in technology and the microcomputer industry

### Language Lets Anyone Do Windows, Develop Programs with Modern Look, Graphics Interface

evelopers at Carnegie-Mellon University in Pittsburgh say they've got a computer language that will let nonprofessional programmers write programs that use those hot graphicsoriented features characteristic of today's operating systems, such as windows, pulldown menus, and multifont text. The language is cT, short for CMU Tutor. Tutor was originally part of the PLATO educational system at the University of Illinois, but according to Bruce Sherwood, associate director of Carnegie-Mellon's Center for the Design of Educational Computing and one of cT's developers, this new language goes far beyond the original.

The language is "really designed for any kind of computer programming, including research computing. It's a general-purpose language for any situation where you're going to have a modern user interface," Sherwood said. It's also highly machine-independent, he said, because cT implementations are designed for font and graphics rescaling; the same cT source code will run on a Mac, a Sun, an IBM RT PC, and a microVAXand on most of those machines, Sherwood said, cT is

the only language that lets ordinary people program using graphics and multifont text.

"One way of describing Tutor languages is to say that their goals and methods are reminiscent of a very good BASIC," Sherwood said, but cT begins "from the expectation that you're writing a program for somebody else to use." For example, Tutor's input statement lets the program not only get input from the user, but also make sure it's the right kind of input. "The programmer doesn't have to do all the analysis to make the validity checks. You're encouraged to look," Sherwood said.

"There are five things any language has to do. Calculate, display, sequence, analyze input, and read and write files. Where cT is strong is display, sequence, and analysis.'

A cT program consists of a set of root-level procedures called "units"; these can accept parameters by value or address and return a result. Units are linked with the commands next and previous: A user can pull down a menu and click on previous and review the previous unit. "With Tutorreally a whole archipelago of these unit islands, and there are some interesting structures between the islands," Sherwood said.

Source and execution windows are both active; because fonts and graphics can be scaled, you can see a miniature version of your execution window if you like. A programmer can select a source-code coordinate by clicking the mouse at a point in the execution window. There's also an online reference manual, complete with working examples that you can cut and paste into the source window and execute. "It's a fabulous situation for programming by example," Sherwood said.

At Carnegie-Mellon, cT has been in use for a year, but it's only now becoming commercially available. The Macintosh version, which runs on the Mac Plus, the Mac SE, or the Mac II, is \$92.50 from cT Distribution, Center for the Design of Educational Computing, Carnegie-Mellon University, Pittsburgh, PA 15213, (412) 268-5638. An IBM PS/2 version will follow shortly, and a Unix version (running under X-Windows) should be available later this year.

### **NANOBYTES**

 "Computer Chip Saves Nation from Attack of Killer Bees." We might be seeing that headline sometime in the future if researchers at a Martin Marietta lab in Oak Ridge, Tennessee, succeed in a project that will use a chip to track the infamous killer bees. The device, which a spokesperson said weighs "about as much as a grain of salt," will transmit an infrared signal that can be picked up as far as a mile away. Researchers, who want to monitor the mating and foraging habits of the aggressive creatures, have managed to glue the chips to captured bees, and the bees have been able to fly with the chips stuck to their bellies. The engineers hope to have a working transmitter by next year. The deadly buzzers are projected to cross the Texas border into the U.S. in the next few years.

 The new MathStation program from MathSoft (Cambridge, MA) not only cuts coding chores but also lets you laserprint a screenful of equations and formulas and get a page that looks like it came from a typeset textbook. The program, which is an interesting combination of page-layout and equation-solving software, converts the material on screen (displayed in WYSIWYG style) to PostScript.

You control the fonts and spacing. But the procontinued

### Texas Instruments Mixes GaAs and Silicon on Same Chip

class languages, a program is

n the chip-making business, silicon and gallium arsenide (GaAs) are like water and oil-they just don't mix. The standard ways to make chips from each substance are almost completely incompatible; silicon

chips use TTL-level inputs and outputs, for example, while GaAs typically runs at microwave frequencies. It's only recently that one company, Gazelle, has created a GaAs chip that can be used in conjunction with conventional silicon chips.

**But Texas Instruments** researchers have now demonstrated the first ICs that contain both silicon and GaAs transistors on the same piece of silicon. Ac-

continue

### **NANOBYTES**

gram also parses and

you input, using the

compiles the equations

host system's FORTRAN

compiler. MathStation, which company VP and MathCAD creator Allen Razdow said is based on the concept of an incremental compiler, interprets equations as mathematical objects and generates executable FORTRAN code, which can be used in other applications. Any equation can be converted into a FORTRAN77 routine, he said, freeing the user from such chores as coding and debugging. Although the first version (\$9500 per license) runs only on Sun 3 and 4 workstations, the company intends to do an edition for the Sun 386i. A Mac II version will have to wait until the machine supports X-Windows, Razdow said. • Despite U.S. software companies swooping like Chuck Norris into Far East countries where piracy is said to be rampant, the problem of illegal copying is probably going to get worse, says one attorney who has studied the problem. You can go to Hong Kong and get Lotus 1-2-3. dBASE, Word, or other programs for about \$6 a package, Los Angeles lawyer Mike Scott told us after a fact-finding mission to Hong Kong and China, neither of which has laws protecting software copyrights. Software pirating is worse in Hong Kong, where it's an industry controlled by organized crime, he said. Customers from the U.S., Australia, and Singapore buy suitcases full of software, Scott

continued

cording to Hisashi Shichijo, who developed the new process along with Richard Matyi, "This means we can take advantage of the merits of gallium arsenide and silicon on the same chip."

Shichijo said the new process is significantly more complicated than the Gazelle approach, which will allow designers to mix GaAs and silicon chips on the same circuit board. The new TI process mixes the materials on the same chip. "A chip designer traditionally has to choose between the two," Shichijo said. "Gallium arsenide is faster. but it has problems—it's small, it's fragile, it breaks, it has defects—so it's not possible to build largescale circuits. What we've done is to deposit localized gallium arsenide films on a silicon substrate, so you can add GaAs devices or circuits to silicon circuits.'

This makes large-scale GaAs circuits practical, but

because the silicon and GaAs circuits can be mixed on a chip, large-scale GaAs won't usually be necessary, Shichijo said. "You can put the GaAs where you'd really like to have speed, and use silicon for the rest of it." For example, silicon memory could incorporate GaAs control logic for better response time; a dense silicon microprocessor might have an integrated GaAs register file or cache.

In developing the GaAson-silicon epitaxial growth technique, the TI researchers aimed to develop a process that could be applied directly to high-volume production. According to Richard Matyi, "Because silicon processing is extremely sensitive to the presence of impurities-and GaAs essentially represents an impurity-we completed silicon processing before we added the GaAs. And although it would have been simpler to grow the GaAs atop the silicon in layers 2 to 3 micrometers thick, we decided to embed the GaAs islands in the wafer to produce a coplanar surface. Devices with such flat surfaces are easier and more cost-effective to manufacture in high volume, and they're more reliable."

Shichijo said GaAs optical devices, such as lasers, could be included on silicon chips to speed up chip-to-chip communication by a factor of 10. To demonstrate the new chip, the researchers produced several ring oscillators that mixed silicon CMOS and GaAs metal semiconductor field-effect transistor circuits.

But some designers say GaAs has a long way to go before it's a commercially viable component of desktop computers. They think it will be a long time before chip makers can produce GaAs on silicon substrates at good yields, and they may never overcome problems inherent in GaAs circuitry.

### DCA/Intel Spec Could Mean Communications without Bit-Twiddling

The new DCA/Intel Communicating Applications Specification (CAS), put into the public domain in August, could simplify electronic communications if enough hardware and software vendors use it to develop communications interfaces for use in their applications.

CAS is a specification for writing code that intermediates between an application and a communications service. Using CAS, applications can transparently direct output to the communications device in much the same way that data is transparently sent to a printer. The initial release of CAS supports communications only via facsimile modem hardware (such as Intel's new Connection CoProcessor).

However, subsequent releases will support Hayescompatible modems and PC-mainframe communications boards.

A software developer can use the CAS to write a communications program, which can be integrated with the primary application. Symantec has already integrated CAS functions with its Q&A software, allowing Connection CoProcessor users to transparently send Q&A files to other fax machines by selecting a menu option from within O&A. Other software vendors, such as WordPerfect, Borland, Lotus, and Ashton-Tate, said that they will support the CAS.

The CAS consists of two hardware-independent software components. The Res-

ident Scheduler controls the destination and scheduling of file transmissions between the sender and the recipient. The Transfer Agent, similar to a device driver, handles the details of connecting to the recipient, ensuring accurate data transmission, and disconnecting from the communications session. CAS provides rules, codes, and functions for implementing the scheduling and device driver tasks.

Widespread support of CAS could have a major impact on the often-incompatible world of electronic communications. One company is working on using CAS and the Connection CoProcessor as a gateway to allow remote users to access LANs at 9600 bps. With

continued

said. And a contact in

# The Bus Stops Here!

Introducing Wells American's CompuStar Multi-Bus Business Computers. The world's first and only multi-processor, convertible bus microcomputers.

Ask any computer expert about what type of system you should buy nowadays and you'll likely get a "pass the bus" response. Something like — "Well, uh, the PC/AT\* bus is your best buy but, then again, the new PS/2\* bus may become the next industry standard." Great advice, right? If trying to decide on a processor weren't tough enough, now you're expected to pick a bus, too.

### RELAX, NOW THERE'S COMPUSTAR'S

The all new CompuStar® from Wells American not only lets you interchange microprocessors, you can also mix and match buses — a PC/AT bus, a PS/2 bus or. . .both. As your computing needs change, simply snap in a new processor or add an extra bus. You'll never again have to worry about buying the wrong computer system!

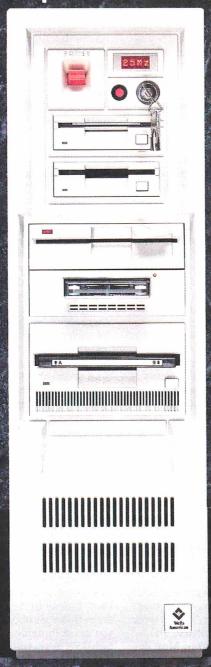
### FOUR COMPLETE SYSTEMS IN ONE.

The CompuStar can be configured with any of four microprocessors — an 8086, an 80286, an 80386SX, or an 80386. The processor and up to 16 megabytes of user memory have all been combined, using the latest VLSI technology, on a single, plug-in CPU module. Plus, any time during the first year of ownership, CompuStar users can "trade-in" the CPU module they initially selected toward the purchase of any of the other more powerful modules. Nobody but Wells American gives you this kind of value.

### CONVERTIBLE BUS? YOU'RE KIDDING!

No, we're not. In fact, it may well be the most practical microcomputer innovation ever. Say you've selected an AT compatible CompuStar and later want to add PS/2 compatibility. No problem! Snap in a PS/2 Bus and Adapter Module and you can use both buses in the same system. Likewise, if you've selected a PS/2 compatible CompuStar and decide you want to add an AT bus, just snap in an AT Bus Module. Depending on configuration, the CompuStar can have up to 13 bus expansion slots — all AT slots, all PS/2 slots or a "split-bus" of AT and PS/2 slots. Best of all, you can reconfigure your CompuStar whenever you want.

\$1995



The CompuStar is also easily expanded. That's because there are seven CompuStar disk/tape compartments — six accessible from the front and an additional full-height bay inside. All this in a sleek, compact tower design that actually leaves more room on your desktop than any of the so-called "desktop" models.

### A NEW IDEA FROM AN OLD COMPANY.

The CompuStar® Multi-Processor, Convertible Bus™ Microcomputer. It's no surprise that our engineers invented it. After all, we've been making microcomputers longer than anyone else. ... even longer than IBM! And if that kind of experience doesn't impress you, CompuStar's service programs surely will. You can select an optional overnight module swap-out plan or on-site service from General Electric Corporation — one of the most respected names in consumer electronics. And, of course, every CompuStar carries a full one-year factory warranty.

### FINALLY AFFORDABLE TECHNOLOGY

Think all this technology sounds expensive? It's not. CompuStar 20MHz 80286 systems start as low as \$1995†. There are also inexpensive 8086 and powerhouse 25MHz 80386 systems available. Plus, there is a wide variety of CompuStar display, tape and disk options including a one gigabyte erasable optical disk. You can choose a factory preconfigured CompuStar or custom design one yourself. Just unlock the front panel and literally "snap-in" a bus, CPU or disk module in a matter of seconds. It's system flexibility never before available. . .at any price.

While one of our competitors (we won't mention any names) threatens you with "missing the bus," most simply pass the bus. Our new CompuStar however, eliminates the bus problem altogether. Not to mention the processor problem. Even the expansion problem. Prove it to yourself. Call today about our CompuStar 31-day trial offer. Oh, and by the way, the next time anyone asks, tell 'em you know where the bus stops.



### **NANOBYTES**

Singapore said residents there can easily go to Malaysia and pick up pirated products. Relentless legal pressure could make it too expensive for pirates to operate, Scott said. "Doing one raid and having a news conference won't solve the problem."

- Unix and OS/2 will be the prevalent operating systems in server environments, according to a new report from Forrester Research (Cambridge, MA). And why's that? Primarily because they stay basically the same across different vendors' hardware and free users of client/server systems from proprietary designs, a Forrester researcher said. By 1992, Unix will be the big operating system on highend database and faulttolerant machines, and OS/2 will be used with more than half the file and print servers, the researchers say.
- Unix is also the best environment for electronic publishing, says another research group, because of its multitasking, multiuser features. "Efficient handling of graphics is the name of the game," said Ajit Kapoor, vice president of CAP International (Norwell, MA). And Unix does that better than any other operating system currently available, he said. Unix skeptics, though, say it lacks the applications to woo new users. But Kapoor said all that will change. And how about that user interface? According to CAP, Unix proponents expect that the cosmetic surgery proposed by AT&T/Sun and the Open Software

continued

built-in support of CAS in software applications, transparent file transfers and electronic messaging will be possible between incompatible or remote systems. As Borland's Rob Dickerson put it, "You won't have to be a bit-twiddler to use communications." Contact Intel PCEO at Mail Stop CO3-07, 5200 Northeast Elam Young Pkwy., Hillsboro, OR 97124 or call (800) 538-3373.

### Memory Chips Have Brains, Do Processing Jobs

fter hitting too many snags and nixing a project to build a massively parallel matrix-multiplication analog chip for pattern-recognition applications, Oxford Computer (Oxford, CT) founder Steven Morton hit upon the idea of what he calls "intelligent memory chips." With Morton's design, adding memory also adds processing power. The chips, which are strung together in a module that fits in the palm of a hand, do more than serve as memory devices; they also take care of some of the processing chores, which gets around the slowdown caused by moving bits back and forth between memory and the central processor.

In an interview at the International Conference on Neural Networks, Morton said that standard memory is inefficient for matrixintensive applications, such as three-dimensional graphics and pattern recognition, because data must be moved out of memory to a separate processor for com-

putations and then returned to memory for output of the results. Intelligent memory chips have the capacity to perform "intense computations and work cooperatively," he said. The capability to perform on-board matrix manipulation also distinguishes the chips from so-called smart memories, such as video dynamic RAMs, that include on-board shift registers.

Morton points out that his chips are not suited for applications that don't require intense matrix manipulation—so don't plan to replace your conventional memory chips and expect a blazing performance increase with your word processor. And he's currently looking for financial support to manufacture the chips and expects availability in the third quarter of 1989.

The chips can be configured in "intelligent memory modules" that contain from 64K bytes to 1 megabyte of storage to provide 1.28 billion 8-bit multiplications and additions per second for

image processing; 40 million 32-bit multiplications and additions per second for 2-D fast Fourier transforms and real-time 3-D graphics; or 80 million floating-point operations per second.

Each chip provides its part of the matrix solution; the partial results are then accumulated to come up with a final solution. A control chip manages the partial results and provides interfacing to the host bus. All this occurs without transporting blocks of data in and out of memory, tying up the bus, and slowing down the central processor. Morton envisions a graphics board with his special chips that plugs into a system's bus.

Morton claims that his approach skirts the Von Neumann bottleneck encountered when intense computational activity can clog the data bus and overload the processor. "With memory actually manipulating the matrix information, the central processor can go off and do other things," he said.

### Program Will Help with Conceptual 3-D Design

ost CAD and solid modeling programs to-day are intended for preparing detailed, completed designs. However, conceptual and preliminary design tools are mainly limited to 2-D drawing programs. Most designers still do most of their preliminary work on paper and then transfer the design to the computer. One of the main problems with conceptual design on the computer is the difficulty of lo-

cating and specifying points or features of the object in 3-D space. Of course, you can specify any point if you know its coordinates, but in the early stages of design, you're not thinking about dimensions or coordinates. You want to be able to intuitively locate the point on the screen.

To facilitate conceptual design on computers, researchers at Stanford University are working on a geometric editor called a "cutplane solids editor." Instead of using a cursor to locate a point on the screen, the cutplane editor uses a transparent plane that you can move through space with a mouse or some other pointing device. The plane provides a perspective in relation to other points on a 3-D object. According to grad student Larry Edwards, "the objective is to enable the user

continued

removable cartridges Reach for ultimate portability



# 120 MBytes of power, speed and security in a revolutionary, <u>removable hard drive</u>.

t last, the Disk Pack gives you everything you've always wished for in a data storage system. The speed and high storage capacity of a hard drive. The ease and convenience of a floppy diskette. And the safety of a tape backup. All wrapped up in a state-of-the-art rugged unit, about the size of a paperback book. Designed to make your life a lot simpler and more secure.

### True portability is here

Just picture this: With the Disk Pack you carry your whole work environment with you, wherever you go. All your files, all your data stay organized and configured just the way you

created them. Between your office and remote sites. Or home. Or another department. You can even mail a Disk Pack. It's that rugged.

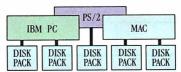
The Disk Pack frees you from the constraints of fixed computers. Your whole

work environment fits in the palm of your hand.

### Total security for your data

Simply slide out a Disk Pack module and lock away your entire business customer base and payroll figures in a drawer or safe. Same for lawyer,

banker or accountant sensitive data and Uncle Sam confidential information. All fully secured in a snap.



Get full data portability and security on the computer of your choice. Macintosh, PC-Compatible or PS/2.

### Blazing speed **Rock-solid reliability Limitless expansion**

Breakthrough technology makes the Disk Pack four to five times more reliable than other removable products. Access times as low as 13 ms make it one of the fastest hard drives on the market. The Disk Pack doesn't limit you to a single storage capacity either. You can interchange 20-, 40-, 80- or 120-MByte modules in your

For more information call



The new standard in data storage technology



system and between systems. Link modules up for a whopping Half-GBvte + of on-line data. Store them for unlimited off-line data. And do lightning-fast data backups.

That's not all. The Disk Pack turns a shared computer into your fully personal machine within seconds. It's ideal for space grabbing applications such as color graphics, CAD. or music. One Disk Pack module does

100 diskettes. Ten times faster. And with a lot less hassle. And thanks to the Disk Pack's unique archi-

the job of

tecture, you'll use it equally

The Disk Pack is ideal for data security. Lock it away and forget about accidental or

intentional data loss.

well on any Mac, Apple, PC-compatible or PS/2 computer. It's that advanced.

Dealer inquiries welcome

20 stor	rage technology isk Pack and ye	v more about Mega Dr v. Please rusb me more our free booklet "20 Va and Maintenance" to	information about the duable Facts About
Facts About Hard Disk	Name		
Care and Maintenance		State	Zip
Mega Drive Systems, In 1801 Ave. of the Stars, Suit Los Angeles, CA 90067 (2	e 507,	Number of Micros	Mac PC

### **NANOBYTES**

Foundation will make Unix more attractive to people baffled by grep and awk. As for another multitasking system, CAP said those Unix users surveyed say OS/2 won't affect their commitment to Unix.

• If you think LCDs are used only in watches and laptop computers, check this out. Hitachi America (Sunnyvale, CA) has a new LCD-based display that measures 2 meters across, has a resolution of 2000 by 2000, and has three lasers projecting the primary colors through high-resolution LCD light valves. The display is controlled by its own computer, which has a serial port and hard disk

continued

to see visual clues between the cursor and the object in question."

The plane can be translated and rotated in real time to intersect an object at any location or angle, thereby eliminating the need for multiple views and giving the user more of a feeling of actually working with a 3-D object.

Once you have positioned the plane, all manipulations (line drawings, intersections, addition of object primitives) are constrained to occur within the plane. Currently, the cut-plane editor uses a polyhedral model to represent objects. The researchers can rotate and manipulate points in the cut-plane/object intersection, rotate the object independently or in conjunction with the cut-plane, rotate about an edge or intersection line, or extrude a cross section of the object.

Eventually, the editor will have other object primi-

tives, such as curved surfaces, granularity, and visual features needed for conceptual design. The current version is written in C and runs on a Silicon Graphics 1400. Edwards said that Lisp would have been ideal. since the program involves the manipulation of lists, but that performance would have been too slow. The cutplane project is under the supervision of the Stanford Institute of Manufacturing and Automation.

### Prototype "3-D Computer" Stacks Processors

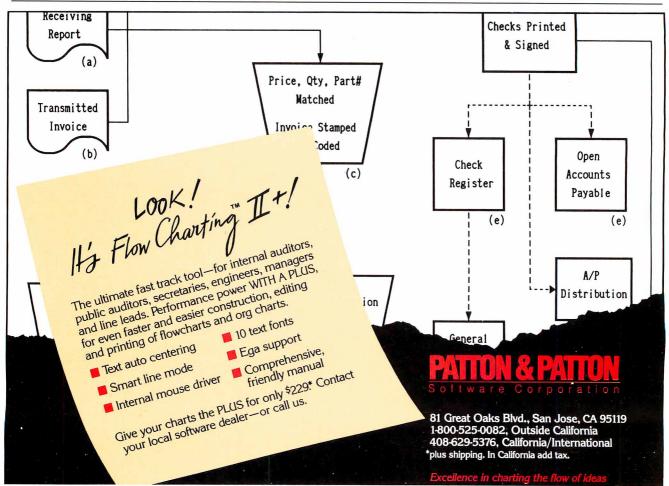
The prototype for a 3-D integrated circuit that packs 1024 processors into a single chip has been developed by scientists at Hughes Research Laboratories (Malibu, CA). The socalled 3-D computer is the

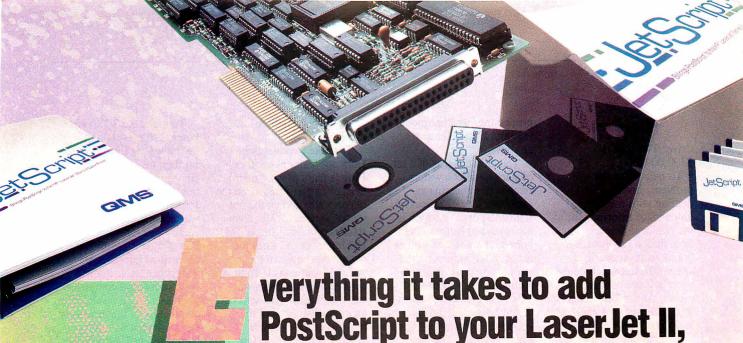
first step in developing an ultrafast machine that squeezes supercomputer power into a processor about the size of a tuna can.

"The 3-D computer is an array processor, architecturally and behaviorally,"

Hughes staff scientist Mike Little told Microbytes Daily (available weekdays on BIX). "That means it has a certain range of applications for example, image processing, radar signal

continued





including HP's blessing. Hewlett-Packard\* and QMS\* have made it easy to give your LaserJet Series II the desktop publishing power of the PostScript page description language.

The new QMS JetScript™.

JetScript is the only Adobe PostScript controller upgrade authorized by HP and designed specifically for the LaserJet Series II. JetScript gives your printer the industrystandard page description language to accompany HP's PCL printer language. This expands your laser printing capabilities. Increases overall printer performance. Yet preserves HP functionality and warranties.

Do it yourself JetScript is easy to install. Just plug in two cards (one in your personal computer\*, the other in your printer), connect a cable and install the software.

The result is a PostScript system with 35 resident Adobe typefaces, three megabytes of RAM, and QMS ASAP™ (Advanced System Architecture for PostScript) proprietary technology for superior performance. All for less than half the cost of a new PostScript laser printer.

New forms of expression The speed and power of JetScript combine to give your LaserJet Series II a form of expression that's found only with PostScript.

Simply, PostScript opens up the full range of possibilities for desktop publishing. You have complete control over the final look of the page, down to the last exacting detail. PostScript allows for an infinite number of font variations and sizes. That makes PostScript's limitless flexibility and power the perfect complement to your LaserJet Series II, giving you the highquality output you require.

**Impressive results** People have come to expect impressive results from QMS—one of the first companies to bring the power of PostScript to laser printing, and now with more PostScriptbased products than any other company.

You'll get the same results from the new JetScript. After all, it has HP's blessing.

Laser Connection is a sales and marketing subsidiary of QMS. Call 1-800-523-2696 for the location of your nearest Laser Connection

\*JetScript available for IBM PC-XT\*, IBM PC-AT\*, HP Vectra™ and compatible personal computers, or the IBM PS/2™ Model 30.



A QMS' Company

Circle 138 on Reader Service Card

The following are trademarks of their respective companies: HP, Hewlett-Packard. LaserJet Series II, HP Vectra of Hewlett-Packard. QMS, JetScript, ASAP, Laser Connection of QMS, Inc. PostScript of Adobe Systems. IBM PC-XT, IBM PC-AT and IBM PS/2 of International Business Machines Corp.

©1987 Laser Connection

### **NANOBYTES**

drive. The cost is \$300,000.

• To help solve the problems involved in dealing with massive amounts of information. the National Science Foundation has awarded grants to several universities with top-notch computer science departments. At the University of California at Berkeley, they'll be working on a hierarchical storage system based on an experimental "super information server" that has an 80-million-instruction-per-second processor, 1 gigabyte of primary memory, 1 terabyte of optical disk storage, 100 high-capacity disk drives, and a fiberoptic network.

processing, weather modeling, and finite-element analysis."

The chip consists of a set of stacked silicon wafers. Each wafer contains an array of 32 by 32 processor segments, each of which is connected to its four neighbors on the wafer as well as to the other wafers in the stack. "We developed two technologies," Little said. "One involves connections through a wafer; the other involves the connections from wafer to wafer. The new technology allows us to re-

think how to partition circuits."

To make a connection from one wafer to another. Little's team uses a "microbridge": an inverted U on top of one wafer and on the bottom of another. "When you stack the wafers, the pair of U's intersect and form the connection between the two wafers," Little said. To make connections through a wafer, the Hughes scientists use an innovative form of thermal migration to create 10,000 channels at a time in each wafer.

To make the 3-D computer, Little explained, "First we put the channels in, then we add the circuitsconventional circuit fabrication from a commercial foundry." Instead of putting a complete processor on each wafer, only one section of the processor appears on each wafer; when the wafers are stacked, each column forms a complete processor. As a result, "the complexity of the processor is how deep it is, not its lateral extent," Little said; a more complex processor could be constructed by stacking more wafers on top of those already there.

The current 3-D computer contains 1024 processors in a 32- by 32-processor array; it's a fixed-point, 16-bit computer in a chunk of silicon 3 inches square and a half-inch high.

TECHNOLOGY NEWS WANTED. The news staff at BYTE is interested in hearing about new technological and scientific developments that might have an impact on microcomputers and the people who use them. If you know of advances or projects relevant to microcomputing, please contact the Microbytes staff at (603) 924-9281, send mail on BIX to Microbytes, or write to us at One Phoenix Mill Lane, Peterborough, NH 03458. An electronic version of Microbytes, which offers a wider variety of computer-related news on a daily basis, is available on BIX.

# With *MapInfo*, More Ways Than Ever To Map Your Data



Pin Map. Automatically use your existing database (from dBASE III or others) with street maps that we can supply. Maps from over 300 U.S. cities and towns contain all addresses, accurate to the correct block and side of the street. Type any address and MapInfo will find it for you. Call to the screen your complete record.



Thematic. Use our boundaries (state or county) or draw your own (sales regions, election districts, etc.). Create a database for the region (population, average income, etc.) Color code boundaries or entire regions based on parameters you define.



Presentation. Use powerful graphics commands to add your own titles, legends and text. Create arrows, windows or callouts. Turn on or off labels of points, streets, bridges, regions, etc.



Visual Database. Draw anything from a floor plan to aircraft design. Store data on any point or region. Create multiple layers to add flexibility to your display.

And that's just a sample. If you need to map your data, MapInfo can do it for as little as \$750. IBM PC or 100% compatibles, with 640K memory, a hard disk drive, and graphics capability.

To order, call 1-800-FASTMAP. In New York State, call 1-518-274-8673 (Telex 371-5584). MapInfo Corp., 200 Broadway, Troy, NY 12180

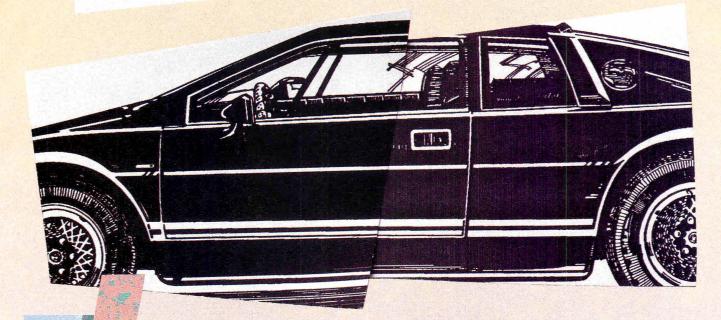


dBASE III is a trademark of Ashton-Tate. IBM and IBM PC are trademarks of International Business Machines Corp.



These unretouched print samples show the superior print quality of QMS-PS 810 over printers using firstgeneration print engines.





### ntroducing the PostScript laser printer that blacks out at high speeds.

The new QMS-PS° 810 can compose and print the most complex pages in record times, with richer, more saturated blacks than ever before. All with the desktop publishing power of Adobe PostScript\*, and the superior print know-how of QMS, an industry leader.

Under the hood QMS ASAP™ (Advanced System Architecture for PostScript) is proprietary technology that helps eliminate the hardware bottlenecks that hinder other PostScript printers. As a result, QMS-PS 810 boasts processing speeds remarkably faster than other PostScript printers in its class. And faster output means greater productivity. In addition, the QMS-PS 810 laser

printer's new Canon® SX\* print engine covers solid areas and prints fine detail better than previousgeneration engines.

Fast start, strong finish You can adorn your documents with one or all of the 35 Adobe typefaces. Thanks to PostScript, there's an infinite number of font variations available. You can also make type as large or as small as you want. And put it anywhere on the page. In fact, with PostScript you enjoy total control over the design of your page. It gives you the complete desktop publishing power to do things that would otherwise be virtually impossible. So you get high-quality output exactly how you want it.

Along with PostScript, the HP LaserJet+™, Diablo® 630 and HP-GL™ printer emulations are added for your non-PostScript software.

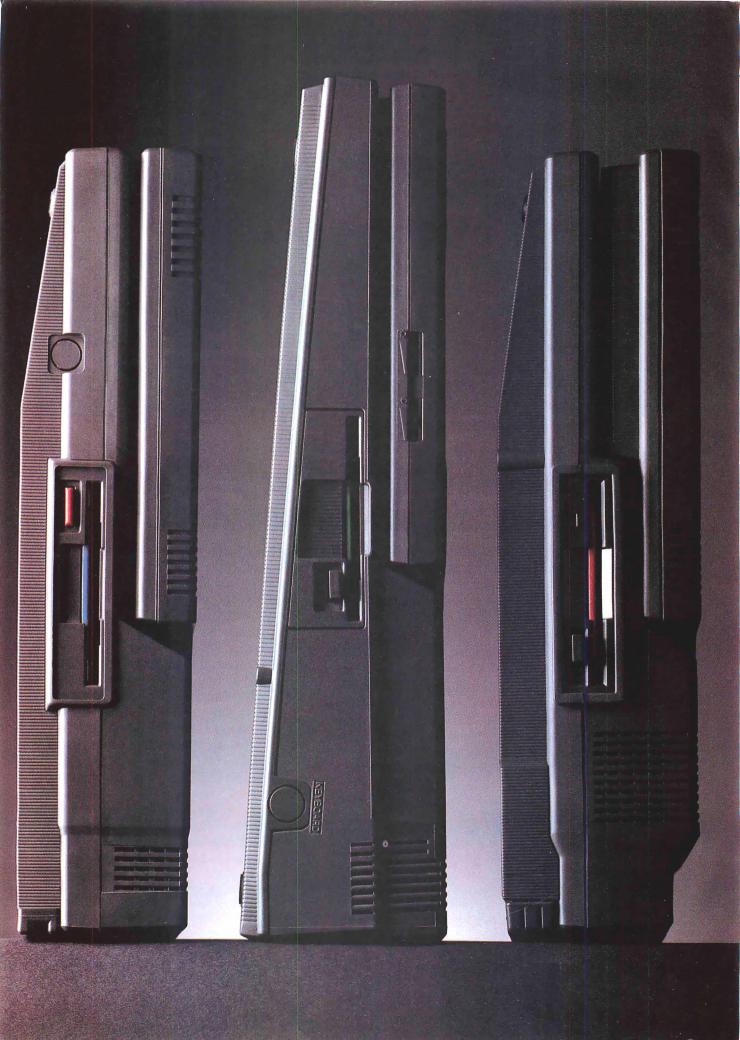
The QMS-PS 810 laser printer is easy to use, maintain, and comes with a one-year warranty. It's available from Laser Connection dealers. Laser Connection is a sales and marketing subsidiary of QMS. For the dealer nearest you call 1-800-523-2696.





A QMS° company

The following are trademarks of their respective companies: QMS, QMS-PS, ASAP, Laser Connection of QMS, Inc. PostScript of Adobe Systems, Inc. Canon, Canon SX of Canon, U.S.A. LaserJet +, HP-GL of Hewlett-Packard. Diablo of Xerox Corp.



# You Can Never Be Too Powerful Or Too Thin.

As portable PCs go, ours may look a bit on the skinny side. But they're by no means undernourished.

After all, each 286 and 386 powered Toshiba portable has an easy-to-read gas plasma screen. Each is IBM-compatible. And each gives you a wide range of features you'd expect only from a desktop PC.

The T3100/20, for example, weighs a scant 15 pounds, yet has an abundance of power. It comes with an 80286 microprocessor and 640KB of RAM that's extendable to 2.6MB. Plus, there's a built-in 20MB hard disk.

Our T3200 has the advantages of a 12MHz 80286 microprocessor, an EGA display system, a 40MB hard disk and 1MB of RAM expandable to 4MB. Also, its two IBM-compatible internal expansion slots let you connect your PC to mainframes, LANs and more. But what's even more impressive is how we managed to fit all this into a slim, 19-pound package.

Then there's our T5100. As amazing as it seems, we managed to squeeze a 16MHz 80386 microprocessor into a slim package that weighs less than 15 pounds. To that we added an EGA display system and a 29

msec 40MB hard disk. As your thirst for power grows, its 2MB RAM can be upgraded to 4MB. And for a limited time, your T5100 purchase entitles you to buy the powerful Paradox 386° database software for only \$299 (nearly \$600 off the retail price).

For more information on Toshiba computers and printers, call 1-800-457-7777. And rest assured that whichever Toshiba PC you choose, you'll be getting the kind of power once reserved for cumbersome desktop computers.

All of which proves you can maintain a position of great power without having to throw a lot of weight around.

Toshiba PCs are backed by the Exceptional Care program (no-cost enrollment required). See your dealer for details. IBM is a registered trademark of International Business Machines Corp. Paradox is a registered trademark of Borland Corp.



In Touch with Tomorrow
TOSHIBA
Toshiba America Inc., Information Systems Division

See us at COMDEX Booth #1458-1468

# Save Money on Quality Software

\$1.99 Per Disk



### **Membership Special**

For only \$19.95 (reg. \$34.95/year) become a MicroCom Systems member and receive:

- "The Shareware Book", a 300+ page guide to shareware for the IBM PC. Includes helpful information for the new PC user! \$12.95 if ordered separately.
- A one year subscription (6 issues) to "Shareware Review", each issue featuring a free new-release diskette from The MicroCom Collection.
- · Reduced member prices!
- Any disks below for only \$1.99 each, (\$2.99 for 3.5") w/money back guarantee!

### Hundreds of disks available. Free catalog with any order!

☐ BUSINESS 1—Easily create, fill in and print business forms. ■ BUSINESS 2—Chart data on bar, pie graphs. Find trends! ★ 2 CAD 1a,b—(2 disks) Paint, draw, design w/Fingerpaint. ★ 2 CAD 2a,b—(2 disks) Create advncd 2D/3D designs. 640K. CAD 3—Generate your own custom flowcharts with PC-Flow 4 COMM 1a,b,c,d—(4 disks) Log onto bulletin board systems. 2 DATABASE 1a,b—(2 disks) The File Express database mgr. ☐ EDUCATION 1—New PC users can painlessly learn DOS. EDUCATION 3—Build dazzling typing speed w/PC-Fastype. ☐ EDUCATION 8—Improve your Spanish w/o dry, dull books! ☐ EDUCATION 9—Learn French skills w/o boring teachers! ☐ EDUCATION 10—Practice German with these easy drills. 2 FINANCE 1a,b—(2 disks) A personal bookeeping manager. 2 FINANCES 3a,b—(2 disks) Prepare financial spreadsheets. ☐ GAMES 1—3-D Pacman, Kong, Spacewar, missiles, etc. ★ GAMES 2—Qubert, Pango, Centipede, Hopper (Frogger). GAMES 3—Blackjack (you set rules), Armchair QB, Empire. ☐ GAMES 4—Star Trek, the orig Colossal Caves Advent, more. ☐ GAMES 5—Hack, you and your trusty dog in a wild adventur. ☐ GAMES 6—Pinball, Othello, Dragons, Sopwith (fly one!). ★ ☐ GAMES 8—Blast enemies w/Striker, conquer world w/Risk.★ GAMES 11—High res Aldo's adventure, MahJongg. EGA. GAMES 12—Try backgammon or Wordplay fortune wheel! 5 GAMES 13a,b,c,d,e—(5 disks) Make yr own advent games! ☐ GRAPHICS 1—Make color slide shows for demos/training! ◄ 3 GRAPHICS 2a,b,c—(3 disks) Produce great 3D graphics. ☐ HUMOR 1—Amuse w/fun faces, unfriendly DOS & more! 2 INFO 1a,b—(2 disks) 150+ grt cooking recipes. Add yr own! 2 INFO 2a,b—(2 disks) Search for addresses w/Zip-Phone xref 4 INFO 3a,b,c,d—(4 disks) Access famous quotes from history 2 LANGUAGE 3a,b—(2 disks) A86 macro assembler/debuggr 2 MUSIC 1a,b—(2 disks) Play tunes or use editor/composer. 2 MUSIC 2a,b—(2 disks) Record or play tunes w/Piano Man! ORGANIZER 1—DeskTeam (Sidekick clone) & Judy calnder PRINTER 1—Packed w/utils for print spooling, banners, etc. ☐ SHELL 1—A simple, fast and easy DOS menu prog for PCs ☐ SIMULATION 1—Fireworks, maze maker, roving eye, etc! ★ ☐ SIMULATION 3—Birdsongs, aquarium w/fish, stars, more. → SIMULATION 4—High res flowers, landscapes, fish. EGA. ☐ UTILITIES 1—A collection of invaluable gen'l DOS utilities. ☐ UTILITIES 2—More great DOS utils, incl burnout protection. 2 UTILITIES 3a,b—(2 disks) Total debugger/diagnostic progs. UTILITIES 5—Hard dsk utils to verify, format, park dsk drives ☐ UTILITIES 7—More adv utils; undelete files from hard disks. 2 WORD 1a,b—(2 disks) Powerful PC-Write word processor. ★ Disks so marked above require a color graphics adapter.

### Phone or mail your order today for 24-hour shipment!

MicroCom Systems 3673 Enochs Street Santa Clara, CA 95051 Cost of disks

Membership \$19.95

Shipping \$3.00

CA res tax

Total encl.

**VISA**©1988, MCS

(408) 737-9000 Mon-Fri 7am-9pm, Sat-Sun 8am-5pm



# **LETTERS**

### Lab Lift

Your lab staff has been a magnificent help over the past months. I'm brand new to the microcomputer world, and the lab staff has been instrumental in helping me map that world. Their assistance on general questions, benchmarks, and video has allowed me to take a lead role in the Air Force Small Computer Office.

Please pass along my thanks to your entire staff for their help and for bringing me an incredibly good magazine every month.

> Johnathan M. Wilson, 2d Lt., USAF Computer Systems Test Engineer Gunter AFS, AL

### Where Credit Is Due

The companion articles "The CPU Wars" and "What They Did Wrong" (May) were excellent nostalgia pieces for me. However, both articles attributed the 6502 to Mostek, a Dallas-area firm. The 6502 was originated by some ex-Motorola designers and first produced by MOS Technology, a silicon foundry later purchased by Commodore.

I started with personal computing about the time the 6502 was introduced, and my first "personal computer" was a KIM-1. I still have that computer, and it's in working condition. This machine has a six-digit LED display, a 24-key keyboard, and 1K byte of static RAM.

In 1977, at least one computer scientist rated the KIM-1 as having the "most bang for the buck" in terms of classroom hands-on applications. This capability was generated by the two PIA-style support chips, one 6530-5 (operating system in masked ROM) and one 6530 (no ROM). To this day, more than 12 years after its introduction, the KIM-1 remains a strong example of the effectiveness of dedicated support chips in computer design.

Ralph Tenny Richardson, TX

**Everyone into the Spool** 

In "Weighing the Options" (July), Brett Glass states that "spool" stands for "simultaneous peripheral operation online." That acronym seems to be a recent ad hoc creation. In the old mainframe days, output could be sent to a "spool" of tape to be printed later. That is the origin of the terms "spool" and "spooling." Well, it could have been called "reeling."

Jud McCranie Valdosta, GA

### **Environmental Impact Statement**

I have a comment regarding "A Turbo TSR" by Scott Robert Ladd (July). While he correctly notes that a terminate-and-stay-resident (TSR) program should free up the environment segment, his program should not wait until deinstalling itself to do this. A TSR program should free the environment when it installs itself.

One of the seemingly little known aspects of writing TSR programs under DOS is the proper handling of the environment segment. Unless the resident part of your program uses the environment segment, it should be released during the installation process, before making the TSR call. Unfortunately, many programs—including a lot of commercial TSRs—do not do this; thus, each one I install gobbles up another 600 bytes for a copy of the environment that it never uses. It seems especially strange that programmers waste space in this way when I see some of the tricks some of them do to try to save a few bytes in a TSR program.

The process that Mr. Ladd outlined for releasing the environment block is continued

WE WANT TO HEAR FROM YOU. Please double-space your letter on one side of a page and include your name and address. We can print listings and tables along with a letter if they are short and legible. Address correspondence to Letters Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

Because of space limitations, we reserve the right to edit letters. Generally, it takes four months from the time we receive a letter until we publish it.

# dBASE® Users—Attack the Mac with FoxBASE+/Mac

### New Frontiers, No Fears.

FoxBASE+/Mac gives you the unprecedented ability to run your dBASE programs on the Macintosh immediately—without changing a single line of code! But there's much more. With FoxBASE+/Mac you can create beautiful, robust applications that are truly Mac-like—using the familiar dBASE language!

### Speed and Power.

FoxBASE+/Mac gives you speed to burn—plus the power and performance you've come to expect from Fox. In fact, FoxBASE+/Mac is by far the fastest database system available on the Mac today—up to 200 times faster!

### View Window.

The View Window is the master control panel for FoxBASE+/Mac's graphical, non-programming interface. Use it to open and close files, set up indexes, establish relations, access BROWSE, and even to modify database structures!

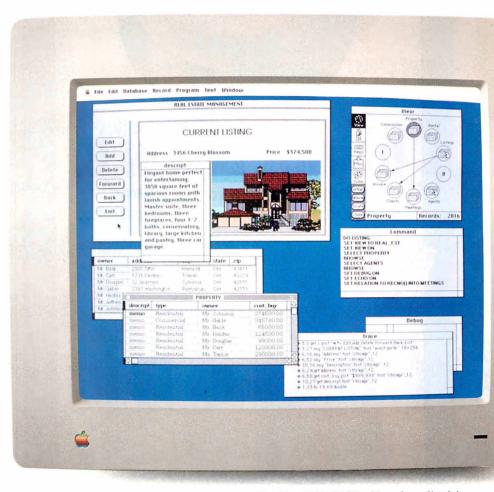
### BROWSE.

FoxBASE+/Mac's BROWSE feature brings new convenience and power to database display and editing! You're in complete control—BROWSE lets you dynamically adjust the size and order of fields displayed, add or delete records, and split the window to show different database sections side-by-side. Together, BROWSE and View Windows eliminate the need to write programs for common database operations!

### **Integrated Graphics.**

Copy and paste graphs, charts, diagrams and even pictures into your database—instantly! FoxBASE+/Mac gives you the power to display these graphics, or merge them into reports and documents!

FoxBASE and FoxBASE+ are trademarks of Fox Software. dBASE and dBASE III PLUS are trademarks of Ashton-Tate. Macintosh is a trademark of McIntosh Laboratory, Inc., licensed to Apple Computer, Inc.



You can create stunning screens like this with FoxBASE + /Mac — immediately!

This actual FoxBASE + /Mac screen photo illustrates the View Window,

Command Window, Integrated Graphics, Memo field editing,

Trace and Debugging Facilities, and the BROWSE feature.

### Command Window.

FoxBASE+/Mac's Command Window gives both experienced developers and novice user ultra-convenient access to the dBASE command language—just type a command into the Command Window, and it's executed!

### Get The FoxBASE+/Mac Facts Now!

Call (419) 874-0162 Ext. 320 for more information about FoxBASE+/Mac. Or visit your local software retailer.

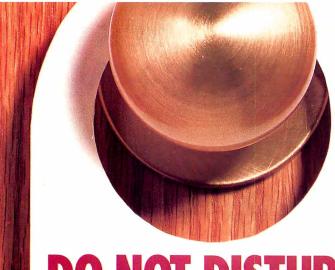


FoxBASE+/Mac is part of the award-winning family of products from Fox Software. For two years in a row, FoxBASE+ has been given the prestigious Editor's Choice award by *PC Magazine*, and scored an impressive 9.2 out of a possible 10 when tested by *InfoWorld*'s Review Board!

### **Fox Software**

Nothing Runs Like a Fox.

Fox Software, Inc. 118 W. South Boundary Perrysburg, OH 43551 (419) 874-0162 Ext. 320 FAX: (419) 874-8678 Telex: 6503040827



### DO NOT DISTURB.

When it comes to AC power, computers need peace and quiet...



Shield your computer and irreplaceable data from all forms of power disturbances including blackouts, brownouts, sags, surges, spikes and noise with the continuous protection provided by UPS systems from American Power.

- For file servers, CAD, UNIX, desktop publishing, and all other computer applications
- Ultra-compact desktop design for easy placement
- Models available rated from 300 to 1200 Volt-Amps for personal computers up to minicomputers
- For unattended operations, many UPS models support a direct hardware interface to operating systems such as Novell, 3-Com, Banyan, Altos, Prime, Convergent, and others Models for international 220 V 50 Hz power are available

American Power Conversion

2 Columbia Street • P.O. Box 3723 • Peace Dale, RI 02883 • (401) 789-5735

Unix is a trademark of AT&T Bell Labs

correct. He just should have made his program do it upon installation, rather than upon deinstallation. I hope you will pass this tip on to your readers and that they, in turn, will use it to write betterbehaved TSRs that don't use up more of our precious RAM than they need.

It seems likely to me that DOS dies with a memory allocation error when Mr. Ladd tries to deinstall QT because he is trying to deallocate memory that belongs to a different program. Since his TSR is no longer the running program, DOS probably regards its attempt to release memory as coming from whatever program QT interrupted, which does not own the segment in which QT resides; hence, the memory allocation error. I have never written a TSR that tries to release its memory on deinstallation, so I don't know the fix for this.

Michael Hanson Seattle, WA

### **Another Option to Weigh**

I have a comment regarding the letter from Dan Mick ("Multiplying Integers," July) and the article entitled "Weighing the Options" by Brett Glass (July).

First, a flaw exists in Mr. Mick's recommended solution. Merely adding the multiplication by (floating-point) 1 is not guaranteed to prevent the integer overflow. The parsing algorithm used by the compiler may detect (and generate code for) the integer-integer multiplication and then perform the promotion to floating point for the "1.0" multiplication. At the very least, place the "1.0" factor between the two integers. Even better, use parentheses to force the floating-point conversion first. For example,

20 A = (1.0 \* B%) \* B%

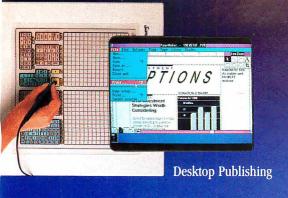
The best solution would be to use an intrinsic conversion function, which should be supplied with the compiler and/or run-time system—something on the order of the following (the actual function name may vary with the compiler and language):

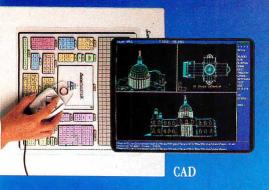
20 A = B% \* CSNG(B%)

Now for a comment on Mr. Glass's comparison of Amiga signals to semaphores. As the owner of an Amiga A-1000, I could not let this mistake stand, especially as KickStart 1.2 implements both signals and semaphores.

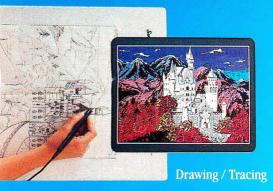
Amiga signals are closer in nature to the event flags of VAX/VMS. Each Amiga task has its own set of signal bits;

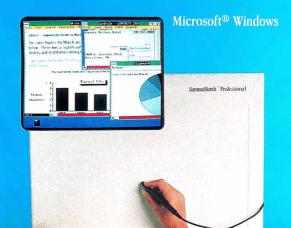
continued











# Hands down, the best selling most compatible graphics tablet you can buy.

SummaSketch is the world's best selling tablet because it's filled with "Plus's". Like full IBM connectivity with the PC, AT and PS/2. Plus full Microsoft® compatibility through a Universal Mouse Emulator™. Plus a separate tablet driver for Microsoft Windows. Plus a two-year warranty. Add that to our standard features — like high resolution and accuracy with the most software compatibility — and you have the tablet with all the Plus's. The 12″ × 12″ SummaSketch Plus.

New 18" × 12" Version. Now you can get all these great features in our larger SummaSketch® Professional tablet. All the Plus's, plus more active

Fairfield, CT 06430 • 203-384-1344

Circle 247 on Reader Service Card

FREE! \$245 TEMPLATE.

Your choice: AutoCAD®, VersaCAD®, CADkey® or Microsoft® Windows tablet template, free. Details inside SummaSketch box.

١	( ) Send me more information or
Į	the AutoEase template offer and on
ł	SummaSketch tablets.

area to work with!

me: \_\_\_\_\_

Title

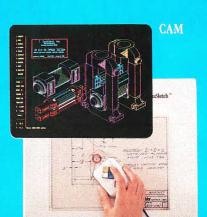
Address:

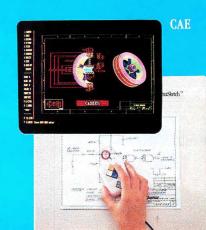
State: \_\_\_\_\_\_ Zip:

Mail to: Summagraphics Corporation 777 State Street Ext. Fairfield, CT 06430

B 10/88

© 1988 Summagraphics Corporation. All rights reserved.









"We created a monster."

Apparently, we have surprised a few people. It's not every day that someone builds the world's fastest 386/20.

Our marketing people call the concept AMMA – for Advanced Memory Management Architecture.

I don't care what you call it. This is the computer that has left everybody behind, including Compaq.

For the moment, we are overjoyed. But this is a game of leapfrog and we do not intend to rest.

The Step 386/20 from Everex is a monster of a machine.

For price and performance facts, call Everex Computer Systems Division at 1-800-356-4283. Everex, 48431 Milmont Drive, Fremont, CA 94538.

### "If this is a race, we are out in front."

Steve Hui, President Everex Systems, Inc.

 IBM PS/2 Model 80 (20 MHz)
 3.52 MIPS

 Compaq DeskPro 386/20
 4.59 MIPS

 Everex Step 386/20
 4.91 MIPS

Power Meter MIPS Version 1.2. The Database Group.



in use, a bit will be allocated to some event that the task is interested in (mostly I/O completion), and the task then waits for the bit to be set. Semaphores, on the other hand, tend to be global to the system, where multiple tasks can obtain access to a single semaphore.

In fact, the Amiga implements two different types of semaphores. An immediate bit-test form allows for a simple test-and-set call (which returns immediately, with a success/failure status) or an unconditional wait-for-semaphore call (which does not return until the semaphore has been obtained). The messagebased form allows for semaphore requests to be queued; a task can submit a request for the semaphore, continue processing, and, at a later time, test (or even wait) for the availability of the semaphore.

A bit of humor appears here. The Amiga calls Procure(s) and Vacate(s) bear a suspicious resemblance to the classical P(s) and V(s) semaphore primitives of Dijkstra-which Principles of Concurrent Programming (M. Ben-Ari, Prentice-Hall International) claims are derived from the Dutch words for Wait and Signal, respectively (Wait and Signal already having been taken up by earlier releases of the Amiga Exec).

> Dennis Lee Bieber Sunnyvale, CA

### Going from .MAC to .ASM

First, I'd like to thank Rick Grehan and all the people responsible for the Small-C compiler. Rick's suggestion about changing the output of the compiler from .MAC files to .ASM files is a good one, since I'm basically lazy and don't like typing the extension when I'm assembling the files.

If any of your readers want to make the change from .MAC to .ASM, the code is contained in the CC11.C file under the openfile() function. Simply change strcpy(outfn + j, ".MAC"); to strcpy(outfn+j, ".ASM");.

While in the CC21.C file, users might want to fix a small problem with the usage line. When cc86 and any invalid character is typed, a usage line is presented that informs the user of the options available to the compiler. For example, if you type cc86, the response usage will be cc [file]...[-m] [-a] [-p][1#][-o].

The usage will give you all this and a few garbage characters. To fix it, you simply look at the end of the ask() function after the last #endif and change sout(NEWLINE, stderr); to sout ("\n", stderr);. The explanation of this is that sout is expecting a string, and although NEWLINE is a linefeed (character 10), sout has a problem with this. It really goes deeper; it has to do with the way fpute expects "\n" to escape for a new line, while NEWLINE is a raw linefeed.

Enough of that. Thanks again for the compiler. I'm having a blast with it.

> Gary Flynn San Gabriel, CA

### **Practically Speaking**

Peter Wayner's remarks on "Error-Free Fractions" (June) are correct from a theoretical point of view. Practical application, however, will be difficult, even if special processors and compilers could be realized for calculating the way he

The problem is the degree of precision that can be obtained, in relation to memory use and execution time. For in-

continued



### Power, Speed, Performance,

We listened to you and added hundreds of features to PC-Write.

Larger Files — Break the 60K file limit! Use all available DOS memory to edit large documents. Rapidly search and switch between related files. Lock files on a network.

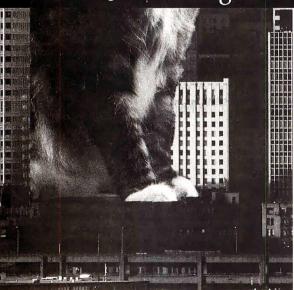
More Formats — Edit multiple columns on-screen.Or mark text as a box, then position and format it. Create tables and scripts faster.

Easier To Use - Stay on track with on-screen "reminder" lines. Select page layout and fonts with new menus. Fix typing mistakes with our improved spelling checker.

### New catalog adds value.

We offer popular products that work well with PC-Write.

### PC-Write 3.0—Working on a whole new scale



New Capabilities - Choose products such as InSet<sup>™</sup> graphics, WordFinder™ thesaurus, or popular soft font, grammar checker, foreign language, and scientific packages.

Special Discounts - Registered PC-Write users get phone support and reduced prices for all products.

### Still only \$89.

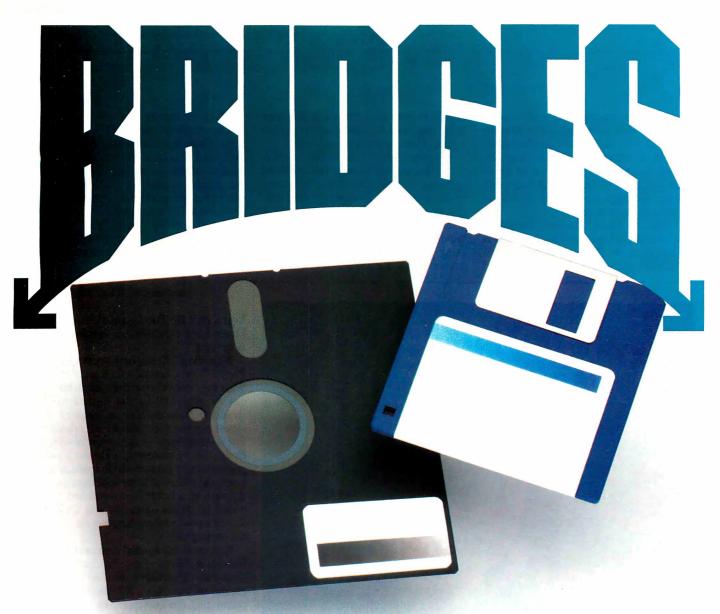
The \$89 registration fee gives you software, user's guide with tutorial, phone support, two free updates, and our newsletter. PC-Write 3.0 is still shareware, so you can give copies to others to try, free!

### Order PC-Write 3.0 today. Call 1-800-888-8088 BYTX

90-day money-back guarantee

PC-Write is not shareware outside the U.S. and Canada. PC-Write™ Quicksoft. WordFinder™ Microlytics. InSet™ InSet Systems. Quicksoft, Inc., 219 First Ave N #224-BYTX, Seattle, WA 98109. 206-282-0452.





### The easy way to move files between the 51/4" world of PCs, and the 31/2" world of PS/2s, Laptops, and 386s: Sysgen's Bridge family.

Because your PCs, PS/2s, 386s and laptops all talk to different floppy disk sizes and formats, they can become frustrating islands of information.

For the simplest way to get files back and forth, just install Sysgen's Bridge products. Presto: Your different computers can talk to common diskettes.

Sysgen pioneered bridges. Now here are three ways to simplify your life in a multi-computer office.

### **Solution 1: Our Bridge-File 5.25** floppy disk drive.

A best seller, with over 50,000 installed. Attach it to your PS/2, and you can read and write files from PCs. Critics and users alike have raved

about its small footprint, ease of use, and dual density capacity of 360Kb and 1.2Mb. (IBM's drive is twice the size, yet stores only one-fourth the data.)

Every PS/2 user deserves this easy connection to the world of PCs.

### **Solution 2: Our Bridge-File 3.5** floppy disk drive.

You get 720Kb and 1.44Mb capacities. Connect it to any PC, and you can read and write files from PS/2s, 386s, laptops, and other 31/2" machines.

Now all your PCs can share files with your newer systems.

And here's the ideal controller: The Omni-Bridge Controller.

Controls up to four drives, so you can mix and match 51/4", 31/2", and floppy tape drives as you need. This hot card gives you big storage, plus twice the floppy disk and floppy tape transfer performance rates! At only \$95, this is a winner.

Get your computers talking. Call the Sysgen Hotline for the name of your nearest dealer. 1-800-821-2151.



556 Gibraltar Drive, Milpitas, CA 95035 OCTOBER 1988 • BYTE 29

Trademarks: Sysgen, Bridge-File, Omni-Bridge –Sysgen Inc.; PS/2—International Business Machines Corporation. Registered Trademark: IBM—International Business Machines Corporation.

stance, for a precision equivalent to 64 bits, or 19 decimals, only rational numbers can be used whose denominators contain no prime factors larger than 22. Prime-number denominators of more than 5 digits can't be gotten through, not even on the biggest computers, within an acceptable lapse of time.

I think an easier, but less interesting, way of exact calculation with fractions is to simply store the numerator and denominator separately. Memory use and

execution time then remain of the same order (say, 3 or 4 times as much) as with normal floating-point calculation.

Even then, error-free fraction calculation is not useful, because the improved precision is of no importance compared to the loss of speed—except in very special projects. Mr. Wayner's examples of errors in floating-point calculation are rather far-fetched, whereas his results by using factorial-base notation deal with denominators that are composed of very

small prime factors only.

The article is interesting for two reasons. First, the mathematical theory is explained in a clear-cut way. Second, it illustrates an amazing lack of contact, on the whole, between mathematics and computer programming, apart from small circles of super specialists. In high school and college, very little is done on behalf of this (I'm speaking of Holland, but I suppose it's the same in the U.S.).

Derk Boonstra Amstelveen, The Netherlands

### You Can't Be Too Careful

I have a few comments on articles in the June issue.

Regarding "Computers on the Brain, Part 1" in Ciarcia's Circuit Cellar: Warnings notwithstanding, an electrical device attached to the human body should include isolation as close to the signal source (i.e., flesh) as possible. Burns have been documented resulting from battery-powered, FDA-reviewed, professionally manufactured medical devices; the potential is certainly greater in the case of a hobbyist-constructed (and possibly hobbyist-modified) device. Would opto-isolation be possible before the preamps?

Now on to my second comment. Peter Wayner's "Error-Free Fractions" asserts that "it's hard to tell if 501/1024 is greater or less than 5203/10456 without calculating the quotient." In fact, comparing ratio-represented real numbers simply requires a common-denominator cross-multiplication and comparison:

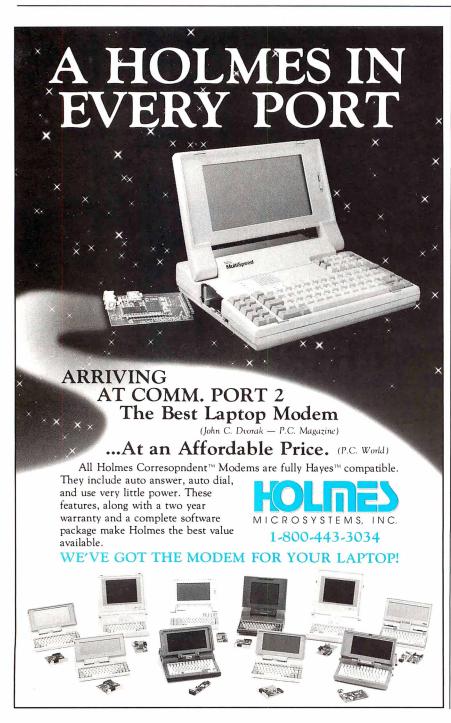
Given  $r_1 = n_1 / d_1, d_1 > 0;$   $r_2 = n_2 / d_2, d_2 > 0;$ Let  $p_1 = n_1 \times d_2,$   $p_2 = n_2 \times d_1;$ If  $p_2 > p_1$ , then  $r_2 > r_1$ , Else if  $p_2 < p_1$ , then  $r_2 < r_1$ , Else  $r_2 = r_1$ .

In this case,  $p_1 = 501 \times 10456 = 5238456$ , and  $p_2 = 5203 \times 1024 = 5327872$ ;  $p_2 > p_1$ , so  $r_2 > r_1$ . By stipulating that the sign is carried in the numerator and the denominator is always positive, this operation works for arbitrary real numbers. Thus, the cost of comparison is two integer multiplies (with double-precision products) and one double-precision compare.

James L. Reuss, Ph.D.

Boca Raton, FL

■





# The Block -- Natural Selection For Software Protection



Inventor and entrepreneur Dick Erett explains how "The Activator" provides sane protection for your intellectual property.

1 n any industry, just as in nature, the process of natural selection raises one solution above another. Natural selection is the most elegant of engineers.

In the area of software protection The Block has been selected by the market-place as the solution that works. Over 500,000 packages are protected by our device.

For the past 4 years our philosophy has been; 'You have the right and obligation to protect your intellectual property.'

### A New Ethic For Software Protection

In allowing end-users unlimited copies of a software package and uninhibited hard disk and LAN operation, The Block has created a new ethic for software protection.



By removing protection from the magnetic media we remove the constraints that have plagued legitimate users.

They simply attach our key to the parallel port and forget it. It is totally transparent, but the software will not run without it.

### A New Technology For Software Protection

Our newest model, The Activator, builds on our current patented design, and establishes an unprecedented class of software protection.

We have migrated and enhanced the circuitry of The Block to an ASIC (Application-Specific Integrated Circuit) imbedded in The Activator.

This greatly improves speed and performance, while reducing overall size. Data protection can also be provided.

### **Programmable Option**

The Activator allows the software **developer** the option to program serial numbers, versions, or other pertinent data known only to the developer, into the circuit, and access it from the program.

Once you program your part of the chip, even we have no way to access your information.

The ASIC makes emulation of the device

virtually impossible. It also presents an astronomical number of access combinations.

### Full 100% Disclosure

Since The Activator is protected by our patent we <u>fully disclose</u> how it works. Once you understand it, endless methods of protection become evident.

Just as no two snowflakes are the same, no two implementations of The Activator are identical. And like the snowflake the simplicity of The Activator is its greatest beauty.



We never cramp your programming style or ingenuity. Make it as simple or complicated as you desire.

Let us help safeguard what's rightfully yours. Please call today for additional information or a demo unit. *It's only natural to protect your software*."

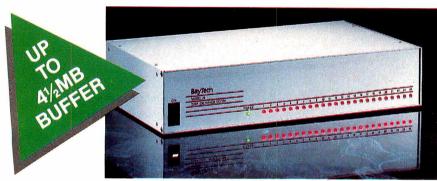
1-800-333-0407 In Connecticut 203-329-8870 Fax 203-329-7428



870 High Ridge Road Stamford, CT 06905

Unlimited Copies • Programmable • Small Size • Fast • Patented • Data Protection

## MODEL 24 high performance DATA EXCHANGE SYSTEM



# Engineered for speed, flexibility and expandability



Bay Technical Associates, Inc., Data Communications Products Division 200 N. Second St., Bay Saint Louis, MS 39520 USA Telex 910-333-1618 BAYTECH, Telephone 601-467-8231 or toll-free

800-523-2702

### **CHECK THE SPECS**

- The Data Exchange System, Model 24, allows high speed exchange of data between computers, printers and other peripherals.
- Powerful 16-bit CPU plus multiple high performance I/O processors allow super high speed transfer of data demanded by new faster computers and software.
- Optimum flexibility: Select the right combination of serial and parallel ports, and set *any* of these ports as a peripheral port or as a computer port.
- Basic unit expandable to 24 ports by 4-port modules offered in serial/parallel combinations.
- Standard 512KB buffer expandable to 4½ megabytes, to handle big print/plot jobs and many small ones.
- Buffer memory dynamically allocated to maximize buffer utilization.
- Simultaneous data input and output on *all* ports, so no devices are kept waiting.
- Computer-to-computer communication concurrent with all other operations.
- Full duplex communication allows file transfer capability with many communications software packages.
- Compatible with virtually all computers, printers, plotters, modems and other peripherals.
- Pop-up RAM resident PC support software allows peripheral selection via hot key.
- Super fast throughput allows data to pass through with no apparent processing delays.
- Many user-definable parameters including separate baud rates, flow control and parity for each port.
- Internal serial-to-parallel and parallel-to-serial conversion.
- Cascading capābility to increase available number of ports.
- Unlimited hotline tech support.
- Designed and manufactured in the U.S.A.

Circle 31 on Reader Service Card

# CHAOS MANOR MAIL

Jerry Pournelle answers questions about his column and related computer topics

The European Market

Dear Jerry,

In your February column ("Life after Las Vegas," page 182), you seemed surprised that in Europe the Atari ST has gained a "serious machine" status, which perhaps it lacks in the U.S. In fact, most Americans don't realize that the computer market here in Europe is quite different from what they're used to. Prices here tend to be much higher for most brand-name machines, and some interesting products are hard to find.

To give you an example, I recently bought an Atari Mega ST2. Its list price, including a 20-megabyte Atari hard disk drive, was about \$2700 here in Italy. Such a price might sound expensive in the U.S., but, for reasons beyond my comprehension, Apple is selling a comparably equipped Macintosh SE (with 1 megabyte of RAM and a 20-megabyte hard disk drive) for \$5700. And dealer margin is low enough that you can't get a discount of more than 10 percent (which is comparable to what you can get on the Atari). As you can see, over here the Atari-even the Mega series-still gives you the most computer for your buck, at least in the 68000 world. In fact, I can buy an Atari Mega ST2 with a hard disk drive and the Atari laser printer for less than I'd have to pay for the Apple laser printer alone.

Given this, if you decide to get off the MS-DOS or OS/2 bandwagon and you don't have a little fortune to spend on the Mac, the Atari seems a good choice. As a result, many small businesses, professionals, consultants, and independent offices are turning to the Atari as a system that is inexpensive and easy to use. The Atari also lets them do their tasks (e.g., word processing, desktop publishing, and communications) at a reasonable price.

Why Apple is pursuing such a policy is a mystery to me, but I think Atari's big success is partly due to Apple's absurd pricing policy. If Macs here sold for what they do in the U.S., the market might be different. But in the current situation, the Atari is very strong, especially in En-

gland and in West Germany, where there's an impressive range of locally written software for the Atari computers.

As for the 80x86 world, the business here is lagging behind the U.S. developments; people are still buying 8088 machines as their first machines, not realizing that those are already obsolete. People are also very confused about the whole OS/2 story—whether it is real, whether it will be real some day, and so on. In fact, with so many hardware and software standards, doing system integration in the PC-compatible game is something short of a nightmare-more so here, because many things that would make your life easier just aren't available here. Often, if you decide to go with MS-DOS, you're stuck between either trueblue IBM (it costs a little less than \$10,000 for a PS/2 Model 60 with a dotmatrix printer) or Taiwanese equipment, which is often sold by dealers with very little competence. Clone machines are usually a good deal, but you'd better know what you're doing, because no dealer will be out there to help you.

Macs are easily available (not so for the software, though, and I know of some official Apple dealers who make good money on pirated software), but at their high prices they have found their natural niche in the academic market.

As you see, the market situation here is quite different, and that explains why some machines—such as the Commodore 64—have been big hits in Europe. On the other hand, the American market tends to be provincial; both users and companies think nothing exists beyond the U.S. Good products (especially software) get developed in Europe, too.

Fabio Favata
Palermo, Italy
continued

Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also earns a comfortable living writing about computers present and future. He can be reached c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458, or on BIX as "jerryp."

# Circle 34 on Reader Service Card Three ways to build better Turbo Pascal programs...

### NEW! POWER SCREEN \$129

Screen I/O manager.
Features: • screen painter • virtual screens
• data validation • context sensitive help
• unlimited screens • definable keys
• & much more!

# Power Tools Plus \$129

Full featured function library.
Features: TSR support direct video access VGA and EGA support mindows and menus DOS memory allocation interrupt service routines

### ASYNCH PLUS \$129

Asynchronous communication manager.
Features: • speeds to 19.2K baud
• XON/XOFF protocol • hardware
handshaking • XModem file transfer • I/O
buffers up to 64K • & much more!

We're Blaise Computing, manufacturers of high quality function libraries designed to reduce the time and technical expertise required for serious applications development.

All of these packages include Peter Norton's Online Instant Access Program, a comprehensive user reference manual with extensive examples, and full sample programs.

Satisfaction guaranteed or return within 30 days for a full refund.

We have a full line of products for C and Pascal. For a free brochure or to order call

800-333-8087!



Thank you for the report. One reason Atari and Amiga sell in Europe is because they don't have to pay so much attention to certifications by the FCC. I do wonder if the FCC's real purpose here is to help the administration deal with the "too strong" dollar. If so, I have news; they've been wildly successful. - Jerry

#### The Trouble with MIS Professionals Dear Jerry.

I'm writing about the letter Charles Hahn wrote you attempting to defend the behavior of corporate data-processing departments ("In Defense of DP Departments," March, page 36). When I first read the letter, I dismissed it as just another point of view that raised some interesting points even if I didn't fully agree with it. However, after more thought, it strikes me that Mr. Hahn's letter is a classic case of what's wrong with many MIS (and managerial) professionals. I also can't help but think that there's another side to his story, and I'd like to hear it.

On one hand, Mr. Hahn is upset about the lack of initiative shown by the people in his company, since they don't like to work voluntary, unpaid overtime and

won't learn how to use their machines on their own time. (I suspect what he means is that people won't take the often boring manuals home to study them to a point just short of memorization. Has he ever tried letting people take both machines and manuals home to experiment with? I've found that technique works.) On the other hand, Hahn is angry that his exdirector, who actually showed some initiative, used his own programs and hardware instead of Lotus and WordStar, which are apparently the only two MISapproved programs.

I can't help but wonder what the situation would have been if Mr. Hahn's company had a policy of listening to its employees and had actually bought the director an IBM PC AT and first-rate software to go with it in the first place. I also wonder what it was that caused the director to leave the company. Corporate attitudes, perhaps?

Frankly, I think the fundamental problem is that many managers forget that no matter what sort of equipment and hardware they may buy to improve productivity, the people who run the machines still determine the ultimate success and/or failure of the operation. While it may be unfortunate for business, the fact is that the people running the machinery aren't machines them-

> George P. Nelson Springfield, VA

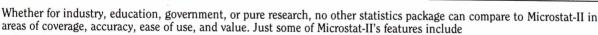
Well, I had much the same thought myself; the purpose of small computers is to enhance productivity, and I doubt very seriously if even the cleverest MIS director has thought of all the ideas. Giving intelligent people good tools and watching to see what they will develop with them has always seemed to me a much better idea. - Jerry

#### Users versus Businesspeople Dear Jerry.

I'm writing in response to Richard H. Goodyear's letter ("No Mac Clones," August 1987). He says that while users have written a lot about the Macintosh, businesspeople have spoken "eloquently by their silence," as there are no Macintosh clones.

It was, as you remarked, an "interestcontinued

## MOST COST-EFFECTIVE STATISTICS PACKAGE AVAILABLE



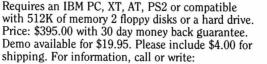
- Descriptive statistics (mean, standard) deviation, variance, kurtosis, skewness, etc.)
- Regression Analysis: Simple, Multiple, Stepwise Multiple, forward and backward
- Correlation Analysis: matrix and cross products table
- ANOVA: Oneway, Twoway, Twoway with replicate
- LSD, Duncan's, Tukey, Newman-Keuls
- Crosstabs and Chi-square

1-800-952-0472 1-317-255-6476

- Hypothesis tests: mean or proportion
- Nonparametrics: Wald-Wolfowitz, Kruskal-Wallis, Wilcoxon, etc.
- Time Series: moving average, centered moving average, deseasonalization, exponential smoothing
- Probability Distributions: Normal, t, F, Poisson, etc.
- Frequency Distributions: value or range.
- Scatterplots (with simple regression)
- Combinations

Factorials, Permutations,

- Up to eight times faster than the competition without loss of accuracy
- Online help plus easy to use keyboard or mouse input; no complex command language to learn
- Unequal case sizes, missing data, and aliased data
- Easy to use data entry system with file import capability
- Only three disks—not copy protected
- Expanded user's manual



#### ECOSOFT INC.

6413 N. College Ave. ■ Indianapolis, IN 46220







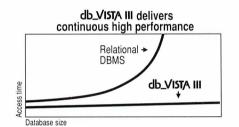
### Programmers

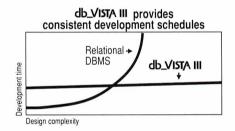
# Portable No Royaltich Choosing the Right Database Development System Just Got Easier.

db\_VISTA III Delivers High Performance With No Hidden Costs.

For database applications development, you want a system with performance, portability, and full functionality at a competitive price. But there's more to it than that. The long term costs associated with extended development schedules, frequent maintenance, excessive royalties, or the inability to handle complex data relationships are often overlooked. These hidden costs can be quite a shock after you have made a commitment and are midway through application development, or worse yet, in production.

With db\_VISTA III from Raima, there are no surprises. It provides powerful database capability with tremendous overall cost savings. The heart of the system is db VISTA, a high performance DBMS that uses B-tree indexing and the network database model file structure to minimize overhead and provide fast data access. Our SQL-based db\_QUERY provides a relational view of the network structure, without sacrificing performance. And db REVISE lets you easily redesign your database. The entire db\_VISTA III system is fault tolerant and complete source code is available.





#### db\_VISTA: High Performance DBMS

Fast data access: B-tree indexing, network database model, virtual memory disk caching Multiple Database Access

Referential integrity Automatic recovery

Record and file locking Database consistency check

Easy-to-use interactive access programs Data Definition Language patterned after C

db\_QUERY: SQL-based Query

Relational interface to db\_VISTA databases Yields extraordinary performance Build ad hoc queries & reports

#### db REVISE: Database Restructure Program Redesign vour database

Converts existing data to revised design Upgrade remote end user locations easily

Add WKS Library for Lotus 1-2-3

Fast C interface to Lotus, dBASE and others Operating Systems: VMS, ULTRIX, UNIX System V, BSD 4.2, SunOS, QNX, XENIX, OS/2, MSDOS, Macintosh, MS Windows

C Compilers: VAX, UNIX, XENIX, SunOS, Microsoft, Lattice, TurboC, LightspeedC, MPW

LANs: NFS, 3Com, NetWare, LifeNet, Banyan, and any other MS-DOS NetBIOS-compatible LAN. AppleShare and network-independent

Thousands of C programmers in over 50 countries worldwide have chosen Raima's db VISTA III. Here are the reasons why:

Reliable Documentation

Audo Recovery

- Fast data access
- Minimal data redundancy
- C source code available
- Automatic recovery
- Multi-user support
- Portable to VMS, UNIX, OS/2, MS-DOS and Macintosh
- SQL-based relational query
- No royalties
- Professional services
- Superior support

Maybe it's time that you checked out db VISTA III. Consider all the costs. It could be the easiest choice you ever made.

#### CALL:

#### 1-800-db-RAIMA (that's 1-800-327-2462)

Ask about the many other products and services Raima Corporation offers, including consulting, application development, and training.

#### See us at ⊕) COMDEX/Fall '88

Booth 9607 Sahara Hotel Nov. 14-18, 1988 Las Vegas, Nevada



ing observation."

I don't like to be judgmental, but I fear Mr. Goodyear is guilty of leading the gullible down that well-known garden path. What makes "users" and "businesspeople" mutually exclusive? If you accept that premise, then you enter the garden.

The absence of Mac clones is another misleading premise. What are GEM and Microsoft Windows if not user interfaces that copy the look and feel of the Mac's operating system?

What inspired the Commodore Amiga and Atari ST series?

And what is all this about an OS/2 for the new IBM systems that has something called the Presentation Manager? Could it be that it will use a mouse and have the look and feel of a Mac interface?

Looks like some businesspeople are about to become users.

Brian Farley Saipan, Mariana Islands

Actually, it will have a mouse and the look and feel of the Lilith, or perhaps early Xerox systems. . . .

I keep trying to start the rumor that

Apple is going to sue Xerox for look and feel.—Jerry

#### Computing on the Go

Dear Jerry,

I'm writing in response to the letter from Bren Jacobson ("Floatable Computer?" March, page 36), who wants to use a computer in a boat. I can't offer much about corrosion problems, but I use computers in motor homes.

People have tried 12-volt DC battery voltage for the drives, plus a few resistors for the 5-V circuitry. And I've found problems because cheap power supplies often depend on one load to balance out another. Then there are all those voided warranties.

My ancient CP/M machines would run on a one-lung light plant, albeit with a flickering CRT that could provoke terminal mal de mer. But when I went to a hard disk, a mechanically governed alternator just couldn't hack it. Nor could a hard disk endure prairie summers with power lines harvesting every lightning strike from Vancouver to Halifax. Problems were exacerbated by RV parks with inadequate wiring. Somebody plugs in one more coffee maker, and there go the last 10 pages....

Five photovoltaic panels and four deep-cycle batteries just about break even for boondocking in the desert. This, of course, also maintains lights, swamp cooler, TV, CB, water pumps, furnace fans, and all the usual hardships of wilderness life.

The 1-kilowatt Vanner inverter turns 12-V DC into 110-V, 60-Hz, pulse-width modulation with 87 percent efficiency, and it will drive any small computer more dependably than most electric companies. It will also drive kitchen appliances for short periods. It cost \$1000 2 years ago, and now it sells for \$500.

G. C. Edmondson Lakeside, CA

From what I've seen you do over the years, you probably have more experience at mobile computing than anyone else in the world. Thanks for sharing it with us.—Jerry

Should We Worry about Viruses? Dear Jerry,

My wife and I work at home in south-

# INDUSTRIAL STRENGTH OOPS.

You have three options in today's world; lead, follow or get out of the way. You've already taken a leadership position in hardware with the latest 286 or 386 system. Now you can use that triple-digit architecture to blast ahead of the pack with the most powerful new Object Oriented Programming (OOPS) software on the market: Smalltalk/V286.

Smalltalk/V, the original oops tool for the PC, gave scientists, engineers, programmers and educators a brand new way to solve problems. And soon they were developing exciting new applications in everything from economics to medicine to space.

Now Smalltalk/V286 gives you true work station performance with industrial strength capabilities like: push-button debugging; multi-processing; portability

between DOS, OS/2 and Presentation Manager operating environments; integrated color graphics; a rich class library; and access to 16 MB of protected mode memory, even under DOS.

The new Smalltalk/V286, which is even easier to learn and use than Smalltalk/V, retails for just \$199.95. Or you can buy Smalltalk/V, still the world's best selling oops, for only \$99.95. And both come with our 60 day moneyback guarantee.

Check out the new Smalltalk/V286 at your dealer. If he doesn't have it, order toll free, 1-800-922-8255. Or write to: Digitalk, Inc., 9841 Airport Blvd., Los Angeles, CA 90045.

And let us put you ahead of the power curve.

Smalltalk/V286

ern France, and, having just bought two 20-MHz Compaq 80386 computers, we are wary of installing French Minitel internal modem cards for fear of malicious computer virus programs that spread through networks and destroy data on hard disks.

We heard about viruses in a *Herald Tribune* article (February 1, 1988) that mentioned a preventive program called Data Physician, edited by Digital Dispatch in Minneapolis, Minnesota.

How serious is this problem, and does the program work?

Peter Clark Forcalquier, France

Well, computer viruses are indeed real enough, but the best preventive is to be sure you don't put unknown software into your machine. There are also a number of companies that sell virus protection programs; just how badly you need one is a matter of judgment.—Jerry

### QuickBASIC 3.0 versus 4.0 Dear Jerry,

I can't agree with your praise of the QuickBASIC 4.0 debugger (Computing

at Chaos Manor, March). You did note its weakness—you can't see the trace and the output at the same time. What you probably fail to realize is the intense inconvenience this causes, with seemingly dozens of strokes to go between tracing and viewing the output and back. When tracing, the output does appear for a fraction of a second with each PRINT, as you note, but you didn't emphasize how visually annoying it is. Further, it is too fast to serve any purpose at all.

I wrote an impassioned letter to Bill Gates about this problem, and I even received a telephone call in response (though not from him). I simply refuse to use version 4.0 until this is corrected. (The 3.0 trace is quite workable. In fact, version 3.0 is quite good.)

I just tried to use the 4.0 debugger once again, but it's still terrible. I'll just have to forgo the goodies like the record structure until Microsoft fixes the crucial debugging operations.

There are some factual errors in your column. First, QuickBASIC will accept the one-line IF...THEN...ELSE structure you worked so hard to eliminate. Granted, it's unreadable, but the

compiler rejection is limited to Turbo Basic and is a drawback to using that language if you're running old programs.

Second, QuickBASIC (including 4.0) still supports use of the same name assignments to different types of variable. Thus, you can indeed declare TEACHER, TEACHER\$, TEACHER\$, and so on. Your problem was that the error duplicate definition is a bug. The correct error, which I found by using 3.0 with your problem, is missing =. Add the =, and the error changes or disappears.

Peter J. Lunde West Simsbury, CT

I haven't had the debugging problems you have, and with QuickBASIC 4.0's ability to step through code, set breakpoints and history, and the rest of the goodies, I much prefer it to QuickBASIC 3.0; but everyone to his own taste.

You're right: QuickBASIC will take one-line statements; I'd already cleaned them up to get them through Turbo Basic, so I never even tried them on Quick-BASIC. Your other point is correct, too, as I found out just after I approved the galleys of the article. Oh, well.—Jerry



# ASK BYTE

Circuit Cellar's Steve Ciarcia answers your questions on microcomputing

#### Mac to PC, Over

Dear Steve,

I am experiencing a disturbing problem as I try to connect my IBM PC XT to my Macintosh 512KE through the RS-422 serial communication port. Although Apple claims that the Mac's serial communication port conforms to the RS-422 standard, I find that the Mac has fewer handshaking lines than the PC. I have no problem connecting data signal lines, but what about the handshaking lines? The Mac has only "handshaking in" and "handshaking out," while the PC has both "+" and "-" for every in and out handshaking line. How can I connect them directly without burning my circuit board?

Chester H. Lin, M.D. Taipei, Taiwan, Republic of China

For years, computer users have been struggling with the nonstandard RS-232C serial interface protocol. There is much less uniformity than the designation "standard" implies. The newer RS-422 protocol has come along and isn't being implemented with any more consistency than the older standard. With both methods, workable connections are frequently dictated by individual software packages—for example, some software watches the RTS/CTS pair for handshaking and ignores DTS/DSR, while other software may do the reverse. Other programs do both or neither, ignoring handshaking entirely or doing it in software with XON/XOFF.

As with many RS-232C situations, the solution to your problem of connecting a Macintosh and an IBM PC XT is a null-modem cable or adapter. That's the easy part, without the handshaking connections. Connect the transmitted data pins on each computer with the received data pins on the other. The handshaking connections are a bit uncertain, and a bit of trial and error with a breakout box may be needed to determine the exact configuration. I'd suggest you first try tying the Mac port's pin 6 to the PC's 17 and 18, and the Mac's pin 7 to the PC's 9 and 16. If that doesn't work, try the Mac's pin 6

to the PC's 5 and 6, and the Mac's pin 7 to the PC's 4 and 20. As a last resort, you may be able to tie all handshaking inputs true and use the system without hardware handshaking (do it in software).

Serial interfacing is more a black art than a logical science. Determining the correct connections is often a matter of systematically trying each of the possible hookups until something works. The buffers and level translators used in serial interfaces, such as the 1488/1489 ICs, are designed to withstand connections between two outputs pulling in opposite directions. There is little likelihood of your damaging your computers by experimenting.—Steve

IN ASK BYTE, Steve Ciarcia, a computer consultant and electronics engineer, answers questions on any area of microcomputing and his Circuit Cellar projects. The most representative questions will be answered and published. Send your inquiry to

Ask BYTE One Phoenix Mill Lane Peterborough, NH 03458

Due to the high volume of inquiries, we cannot guarantee a personal reply. All letters and photographs become the property of Steve Ciarcia and cannot be returned.

The Ask BYTE staff includes manager Harv Weiner and researchers Eric Albert, Tom Cantrell, Bill Curlew, Ken Davidson, Jeannette Dojan, Jon Elson, Frank Kuechmann, Tim McDonough, Edward Nisley, Dick Sawyer, Robert Stek, and Mark Voorhees.

#### **Include Schematics, Please**

Dear Steve,

For about a year, I've been trying to get a schematic and parts for an IBM AT-compatible board without success (the board is the same one JDR Microdevices calls MCT-ATMB). I own two of these boards, but one has a bad programmable array logic (PAL). The good PAL cannot be copied because the security link has been burned away.

I have talked to many wholesalers and retailers, including JDR Microdevices.

None of the dealers I talked to can get schematics or parts for the boards. All boards are exchanged and sent to Taiwan for repair.

I am worried about the future of consumer electronics in the country if foreign countries are allowed not to supply data and parts for repairing their products. Has this country come to the sad state of affairs that we will now be dependent on other countries for repairing our products? It wouldn't cost much to include a schematic with a product. Has it come to the point that we need a law requiring all imported electrical products to include a schematic?

What's going to happen two years down the road when the dealer you bought your board from is out of business and you don't know where he got it, as in my case?

Wayne Anderson Mesa, AZ

The situation you've run into isn't unique. Unfortunately, the solution isn't quite the one you're looking for.

I suspect that the reason you're having trouble getting parts is simply that it's not economical to repair very low-cost electronics. Look at it this way: That mother-board retails for about \$350. The actual manufacturing cost is under 30 percent—let's say \$100. Repair technician time, counting overhead and test equipment, is about \$100 per hour, and diagnosing problems can take more hours than you can shake a stick at.

Figuring your time at \$100 per hour, how many system boards did you waste while tracking the problem down to that PAL?

I don't think we need more laws regarding imports on the books. After all, you had a clear choice: Buy a stock IBM system from an established IBM dealer, with all the support and repair built into the price, or buy a clone with no support. You get exactly what you pay for, and I think that's exactly the way it should be. Folks who need the support are buying IBM; the rest of us aren't.

continued

in'de-pen'dent (in'di-pen'dent) adj. 1. not influenced by others in opinion, conduct, etc. 2. not affiliated; sovereign in authority. -n. (in'de-pen-dence) someone or something independent.

#### FACT:

Many major dealers specializing in programming tools for personal computers are legal affiliates of companies who also publish development software.

#### FACT:

Programmer's Connection is *not* a publisher and is not affiliated to any company that has ever been in the business of publishing software.

When you come to Programmer's Connection. you'll find our knowledgeable, non-commisioned salespeople and technical consultants will give you an unbiased look at the products we carry.

Please join us in our Declaration of Independence. Call Programmer's Connection today and be sure to ask for your FREE subscription to the Connection, our 120 page comprehensive buyer's quide. It contains descriptions for over 800 products by more than 300 manufacturers, and informative articles by leaders in the programming industry.

#### CALL for Products Not Listed Here

#### USA...... 800-336-1166

Canada	800-225-1166
Ohio & Alaska (Collect)	216-494-3781
International	
FAX	216-494-5260
TELEX	9102406879

Business Hours: 8:30 AM to 8:00 PM EST Monday through Friday Prices, Availability, Terms and Conditions are subject to change ©Copyright 1988 Programmer's Connection Incorporated

### **PROGRAMMER'S CONNEC**

20C avaduata	List	Ours	FoxBASE+ by
386 products			FoxBASE+/3
386 ASM/386 LINK by Phar Lap Software	495	399	FrontRunner t
386 DEBUGGER by Phar Lap Software	195	159	Genifer by byte
NDP C-386 by MicroWay	595	539	
NDP ForTran-386 by MicroWay	595	539	VI-
PC-MOS/386 Single-User by The Software Link	195	179	Vcache
PC-MOS/386 5-User by The Software Link	595	539	Vfeature Hard
PC-MOS/386 25-User by The Software Link	995	869	Vfeature Delu
VM/386 by IGC	245	219	<b>Vopt</b> Hard Disk
blaise products			
ASYNCH MANAGER Specify C or Pascal	175	135	F77L-EM/16.
C TOOLS PLUS/5.0	129	99	F77L-EM/32.
PASCAL TOOLS/TOOLS 2	175	135	F77L-FORTR/
POWER SCREEN Supports C and Pascal	129	99	Lahey Person
Turbo ASYNCH PLUS/4.0	129	99	with Toolkit.
Turbo C TOOLS	129	99	
Turbo POWER TOOLS PLUS/4.0	129	99	
	123	33	Microsoft BA
borland products			Microsoft C C
Paradox 2.0 by Ansa/Borland	725	525	Microsoft CO
Paradox 386 by Ansa/Borland	895	639	Microsoft FO
Paradox Network Pack by Ansa/Borland	995	725	Microsoft Ma
Quattro: The Professional Spreadsheet	247	179	Microsoft Mo
Sidekick Plus	200	129	Microsoft OS
Sprint: The Professional Word ProcessorNew	200	139	Microsoft Pas
Turbo Assembler & DebuggerNew	150	105	Microsoft Qui
Turbo Basic Compiler	100	68	Microsoft Qui
Turbo Basic Support Products All Varieties	100	68	Microsoft Wi
Turbo C Compiler	150	105	Microsoft Wi
Turbo C Professional	250	179	Microsoft Wi
Turbo Pascal CompilerNew Version	150	105	Other Micros
Turbo Pascal Professional	250	179	
Turbo Pascal Database Toolbox	100	68	LOGITECH M
Turbo Pascal Developer's Toolkit	395	285	Modula-2
Turbo Pascal Editor Toolbox	100	68	Modula-2
Turbo Pascal Gameworks Toolbox	100	68	LOGITECH M
Turbo Pascal Graphix Toolbox	100	68	LOGITECH M
Turbo Pascal Numerical Methods Toolbox	- 100	68	TopSpeed Me
Turbo Pascal Tutor	70	49	Topopoda III.
Turbo Prolog Compiler	150	115	
Turbo Prolog Toolbox	100	68	SmartMOVE
Other Borland products	CALL	CALL	SmarTERM 2
c language			SmarTERM 2
C++ by ZORTECHNew	100	95	
C talk by CNS	150	139	Periscope I w
Eco-C88 Modeling Compiler by Ecosoft	100	69	Periscope II
Guidelines C++ by Guidelines Software	295	259	Periscope II-
Lattice C Compiler DOS & OS/2, from Lattice	450	289	Periscope III
Mark Williams Let's C with FREE csd	75	68	
Turbo Programmer/C by ASCIINew	499	399	
WATCOM C6.5 by WATCOM GroupNew Version	295	269	Dan Bricklin'
and the second s			Norton Comr
database management			Norton Editor
Clarion Development System by ClarionNew	695	595	Norton Guide
Clipper by Nantucket	695	459	For OS/2
dBASE III Plus by Ashton-Tate	695	399	Norton Utiliti
dBFast dBASE III Plus Comp by dBFast	99	89	Norton Utiliti

F. DAOF	005	040
FoxBASE+ by Fox Software	395	249
FoxBASE+/386 by Fox Software	500	399
FrontRunner by Ashton-Tate	195	175
Genifer by bytel	395	269
golden bow products		
Vcache	60	57
Vfeature Hard Disk Utility	80	74
Vfeature Deluxe Hard Disk Utility	120	111
Vopt Hard Disk Optimization Utility	60	57
	00	٠.
lahey computer products		
F77L-EM/16	695	649
F77L-EM/32	895	829
F77L-FORTRAN Compiler	477	439
Lahey Personal Fortran 77	95	89
with Toolkit	119	105
	119	103
microsoft products		
Microsoft BASIC Compiler	295	219
Microsoft C Compiler 5 w/CodeView	450	299
Microsoft COBOL Compiler w/ToolsNew Version	900	659
Microsoft FORTRAN Optimizing Comp	450	299
Microsoft Macro Assembler	150	105
Microsoft Mouse All Varieties	CALL	CALL
Microsoft OS/2 Programmer's Toolkit	350	239
Microsoft Pascal Compiler	300	199
Microsoft QuickBASIC 4	99	69
Microsoft QuickC	99	69
Microsoft Windows	99	69
Microsoft Windows 386	195	129
		329
Microsoft Windows Development Kit	500	
Other Microsoft products	CALL	CALL
modula-2 language		
LOGITECH Modula-2 Development System	249	199
Modula-2 Compiler Pack	99	79
		139
Modula-2 Toolkit	169	
LOGITECH Modula-2 OS/2	349	279
LOGITECH Modula-2 Window Package	49	47
TopSpeed Modula-2 by Jensen & PartnersNew	100	89
persoft products		
		400
SmartMOVE	149	129
SmarTERM 220	195	179
SmarTERM 240	345	299
periscope products		
Periscope I with 512K Board	695	559
		139
Periscope II with NMI Breakout Switch	175	
Periscope II-X Software only	145	105
Periscope III 10 MHz version	1395	1119
peter norton products		
Dan Bricklin's Demo II	195	179
Norton Commander	89	65
	200	59
Norton Editor	75	
Norton Guides Specify Language	100	65
For OS/2	150	109
Norton Utilities	100	59
Norton Utilities Advanced Edition	150	109

#### ORDERING INFORMATION

FREE SHIPPING. Orders within the USA (lower 48) states only) are shipped FREE via UPS Ground. Call for APO, FPO, PAL, and express shipping rates.

NO CREDIT CARD CHARGE. VISA, MasterCard

and Discover Card are accepted at no extra cost. Your card is charged when your order is shipped. Mail orders please include expiration date and authorized signature.

NO COD OR PO FEE. CODs and Purchase Orders are accepted at no extra cost. No personal checks are accepted on COD orders. POs with net 30-day terms (with initial minimum order of \$100) are available to qualified US accounts only.

NO SALES TAX. Orders outside of Ohio are not charged sales tax. Ohio customers please add 5% Ohio tax or provide proof of tax-exemption.

30-DAY GUARANTEE. Most of our products come with a 30-day documentation evaluation period or a 30-day return guarantee. Please note that some manufacturers restrict us from offering quarantees on their products. Call for more information.

SOUND ADVICE. Our knowledgeable technical staff can answer technical questions, assist in comparing products and send you detailed product

information tailored to your needs.

INTERNATIONAL ORDERS. Shipping charges for International and Canadian orders are based on product weight. The standard rates used are published in the Fall 1988 issue of our Buyer's Guide. If you do not have a copy, please call or write for the exact cost. All payments must be made with US funds drawn on a US bank. Please include your telephone number when ordering by mail. Due to government regulations, we cannot ship to all countries.

MAIL ORDERS. Please include your telephone number and complete street address on all mail orders. Be sure to specify computer, operating system, diskette size, and any applicable compiler or hardware interface(s). Send mail orders to:

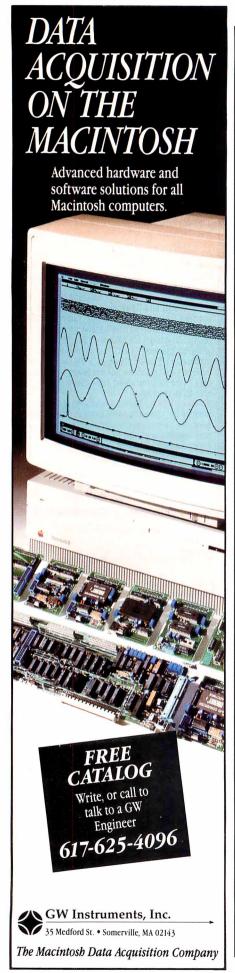
> Programmer's Connection Order Processing Department 7249 Whipple Ave NW North Canton, OH 44720

#### smalltalk language

Smalltalk/V Smalltalk/V 286 Smalltalk/V Support Utilities All Varieties	100 200 CALL	89 175 CALL
other products		
Actor by The Whitewater Group APL*PLUS PC by STSC Brief by Solution Systems Carbon Copy Plus by Meridian Technology db/LIB Database Library by AJS Publishing Desquiew from Ouarterdeck Desquiew API Products All Varieties Epsilon EMACS-pye Text Editor by Lugaru Flow Charting II+ by Patton & Patton Intelligence/Compiler by IntelligenceWare Mace Utilities by Paul Mace Software MathCAD by MathSoft Microport Products All Varieties	495 695 195 195 139 130 CALL 195 229 490 99 349 CALL	449 529 CALL 135 125 115 CALL 169 189 479 85 319 CALL
MICROSTAT-II Statistics Pack by Ecosoft MIRROR II by SOFTKLONE STATGRAPHICS by STSC TLIB Version Control by Burton Systems Software 5 Station LAN Turbo Programmer for Turbo Pascal, by ASCII XENIX System V All Varieties by SCO	395 70 895 100 300 389 CALL	359 63 699 89 269 309 CALL



Established 1984



But look at the economics again. If that \$6000 IBM system dies, the company will swap the board and get you back on the air. The defective board isn't repaired; it's scrapped. After the warranty runs out, you're in the same boat: IBM doesn't supply schematics for its boards any more, either, and the company doesn't repair them. You might have to replace a \$2000 system board instead of a \$350 one.

All in all, I think the only way out is to buy another system board and use the one you've got for a wall hanging. It's expensive, but any other choice is more expensive still.—Steve

### Programming Embedded Microprocessors

Dear Steve,

I am an electrical engineer looking after the operation and maintenance of some of the sophisticated equipment in power stations and substations—equipment like sequential event recorders, digital fault recorders, microprocessorbased alarm systems, and programmable logic controllers. These come under the category of microprocessor-embedded systems.

Last year I subscribed to BYTE to improve my proficiency in troubleshooting and maintenance work. I have had some introductions to microprocessors during my postgraduate education, and I am conversant in 8085 assembly language. While studying BYTE, I felt its contents and coverage were beyond my level, so I decided to seek your guidance.

Please let me know the names of some good books and microprocessor journals dealing with 8-bit microprocessor products being used in industry as embedded controllers. I would specifically welcome books related to troubleshooting procedures, because the documents provided by the manufacturers are invariably sketchy and incomplete. Also, please let me know of any books dealing with the design and application of programmable logic controllers.

Lal Singh Najran, Saudi Arabia

Listed below are several books that I can recommend to help you with applying and programming embedded microprocessors. In addition to the microcontroller handbook, Intel publishes a complete series of guides and application notes describing the various microprocessors that the company manufactures. Contact Intel at the address listed below to receive a complete catalog of Intel books and literature.

Z-80 and 8080 Assembly Language Programming by Kathe Spracklen (Rochelle Park, NJ: Hayden Book Co., 1979).

8080 and Z80 Assembly Language by Alan R. Miller (New York: John Wiley & Sons, 1981).

Intel Embedded Controller Handbook (Intel Literature Sales, P.O. Box 58130, Santa Clara, CA, 95952).

In addition to my monthly column in BYTE, I have begun publishing a magazine entitled Circuit Cellar Ink, which specifically deals with applying electronic solutions to real problems. Subscription information is available at the end of my recent columns in BYTE.—Steve

#### A Circuit Struck Dumb

Dear Steve,

I'm a longtime reader and fan of Circuit Cellar, and I've learned a lot from reading about your projects over the years. From time to time, I've even built some of my own projects after being influenced by your designs.

Back in June of 1981, your project of the month was a low-cost speech-synthesizer interface using National "Digitalker" components. I obtained such a chip set and built a slightly modified version of the circuit to go on the home-brew bus extension I had placed inside the video monitor of my trusty TRS-80 Model 1. It worked flawlessly from the start. Over the years, I've come to appreciate the clearly enunciated warnings and messages that my computer would speak to me while I was looking in another direction reading data statements, keying in bank transactions, or whatever.

Two years ago, I finally became MS-DOS-compatible when I bought a new Tandy 1000A. At last, I had a built-in bus for projects. Alas, I now have a young family, so I can't spend as much time pursuing hardware projects. One that I really wanted to accomplish, though, was to equip the new machine with voice capabilities. Since nobody seems to be writing articles for simple projects for these new machines, I opted to try and modify my old design for the Tandy's PC-ROM vocabulary that I had purchased. I used the Tandy 1000 technical reference manual and your article entitled "Build the Circuit Cellar MPX-16 Computer System," Parts 1 and 2 (November and December 1982) as guidelines for the circuit I came up with.

Unfortunately, the circuit doesn't work. I get no sound from the speaker.

continued

NASA FLIES WITH PROTEUS PCs.
AND SO CAN YOU

PROTEUS 386A opt. 20 MHz

"A 16MHz, zero wait state

The National Aeronautics and Space Administration is a regular Proteus buyer. So are thousands of professionals, as well as small and large businesses nationwide. Including Xerox, GE, Dupont, the U.S. Government, MIT and Harvard. And with good reason:

#### NATIONALLY ACCLAIMED PERFORMANCE AND SUPPORT.

"The Proteus is one of the fastest desk-top computers we tested. Quality has not been compromised, yet this performance system par excellence was WORLD

priced so low." Dec., 1987 WORLD
"The Proteus 386/16MHz is markedly faster than any other PC we've worked with—including the Compaq Deskpro 386/20!" Jan., 1988

#### COMPATIBILITY GUARANTEED.

Every Proteus is American made from the ground up. And guaranteed compatible with all IBM PC/AT

software and add-on prod-ucts. As well as with DOS, OS/2, UNIX, XENIX, NOVELL and all major CAD systems. None is alien to Proteus!

#### SATISFACTION GUARANTEED.

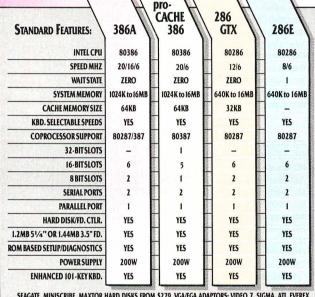
If you're not fully satisfied with your Proteus purchase, return it during the first 30 days for a full refund.

#### THE MOST EXTRAORDINARY SUPPORT IN THE INDUSTRY.

We don't leave you out in orbit after we make the sale, either. Proteus has a contract with a nationwide computer maintenance company.

If something should go wrong with your Proteus system during the first 15 months, we'll send a qualified technician to your site to fix it. Free!

Just call our toll-free technical support hotline any time you have a question or need help. We'll take care of the rest.



SEAGATE, MINISCRIBE, MAXTOR HARD DISKS FROM \$279. VGA/EGA ADAPTORS: VIDEO 7, SIGMA, ATI, EVEREX FROM \$149. MEMORY UPGRADES, COPROCESSORS, MODEMS AT LOW PRICES.

#### **CUSTOM CONFIGURED WITH** TOMORROW'S TECHNOLOGY.

Proteus computers were custom configured to meet NASA's specs. And whether you need only one system or a hundred, we'll custom config-·ure to your exact specifications, too. From a long list of third party, brand name components.

Including 3.5" microfloppy drives, high-speed 1:1 interleave controllers with ESDI and SCSI hard disks and 800x600/640x480 resolution VGA graphics.

IN NI: 201-288-8629 For tech support: 1-800-541-8933



'hot rod'!" "Among the top

8.6 100 products of the year!"

MONOCHROME SYSTEM WITH A 40MB, 28MS HARD DISK

EGA COLOR SYSTEM \$3295

VGA SYSTEM (800x600) WITH A 40MB, 28MS HARD DISK

#### PROTEUS 286GTX



keep its PC/AT and PS/2 computers; I'll take the

WORLD

Proteus 286GTX before those any time. I never want to be without it CompuServe again!" Ernest Mau, Editor

"Fastest machine in the comparison. A superb value"

MONOCHROME SYSTEM WITH A 40MB HARD DISK \$1895

EGA COLOR SYSTEM WITH A 40MB HARD DISK

VGA SYSTEM (800x600) WITH A 40MB HARD DISK

\$2509

#### Proteus 286E

"The Proteus 286E is the clear winner. We recommend it." WORLD

MONOCHROME SYSTEM WITH A 20MB HARD DISK

\$1612 EGA COLOR SYSTEM

\$2095

#### ORDER BY PHONE. IT'S EASY.

You don't even have to leave your desk to order a Proteus system. Or systems. Just call us direct.

The exact configuration you want will quickly land on your doorstep. All you have to do is plug it in, turn it on and blast off into the wild, blue yonder!

377 Rt. 17 So, Airport 17 Ctr, Hasbrouck Hts, NJ 07604 • Telex 510-610-0960 • FAX 201-288-9518 Electronic catalog and 24-hour tech support: set your modem to 1200B/1/8/N dial 201-288-8577 VAR/Reseller/volume discounts available. Payment methods: credit card, COD, company POs



DATA BASE MANAGEMENT	GRAPHICS	UTILITIES	LANGUAGES
Clipper	Energraphics\$186	1 DIR Plus	Basic Compiler (Microsoft) \$175
dBase III Plus	Freelance Plus 309	Bookmark	C Compiler (Microsoft)259
dBase III LAN	Generic CAD w/Dot Plot 3.0 72	Brooklyn Bridge <b>69</b>	Cobol Compiler (Microsoft) 512
DB-XL Diamond	Harvard Graphics 2.1 239	Carousel 2.0	Fortran Compiler (Microsoft) 4.0 259
Eureka	In-A-Vision	Copy II PC	Lattice C Compiler 209
Genifer188	Microsoft Chart 3.0229	1808	Macro Assembler (Microsoft) 86
Nutshell	News Room	Copywrite	Pascal Compiler (Microsoft) 175
Paradox 2.0	Printmaster Plus	Corefast	Quick Basic 4.0
PFS: Professional File 119	PrintShop	Cruise Control29	Quick C
Q&A <b>185</b>	Turbo Graphix Tool Box	Disk Optimizer 2.0	Ryan McFarlan Fortran 379
Q & A Write	VP Graphix	Disk Technician	Ryan McFarlan Cobol 609
Rapid File	Windows Draw!! w/Clip Art 159	Double DOS 4.0 Call	Turbo Basic
Revelation		DS Back-Up Plus 46	Turbo C
R:Base For DOS425	MICE	Fastback	Turbo Pascal 4.0
Reflex	PC Mouse w/Paint	Fastback Plus	Turbo Prolog
VP Expert	(Buss or Serial)	Keyworks	Turbo Prolog Toolbox 89
VP Info	PC Mouse	Mace Utilities47	
	w/Autosketch (Buss or Serial) 99		TRAINING
PROJECT MANAGEMENT	Microsoft Buss Mouse 1.0 92	Microsoft Windows 286 57	Chuck Yeager
Harvard Total Project Mgr. II \$309	Microsoft Serial Mouse 1.0 92	Norton Commander 43	Adv. Flight Simulator\$25
Microsoft Project 4.0 287	MS Buss Mouse w/CADD 107	Norton Editor	Lets C
Timeline 2.0	MS Serial Mouse w/CADD 107	Norton Utilities 4.0 46	Mavis Beacon Typing 29
	MS Buss Mouse w/Windows122	Note It Plus	MS Learning DOS29
WORD PROCESSORS	MS Serial Mouse w/Windows 122	PC Tools Deluxe	MS Flight Simulator 29
	Optimouse	Printworks for Lasers 67	PC Logo <b>79</b>
Easy Extra\$53	(PC Mouse) w/Dr. Halo III 78	Referee	Turbo Tutor 4.0
Word (Microsoft)	INTEGRATIVE COSTWARE	Sidekick Plus	Typing Instructor Encore 27
PFS: Professional Write102	INTEGRATIVE SOFTWARE Ability Plus\$137	Sideways	Typing Tutor IV
Volkswriter 3	Enable 2.0	Smart Notes	
Volkswriter Deluxe Plus	Framework III		SPREADSHEETS
Webster New World Writer 53	MS Works	SQZ Plus	Cambridge Analyst\$80
Webster Pro Spell Checker 32	PFS: 1st Choice	Superkey	4 Word
Webster The saurus	Smart Software System 389	Unlock D Plus 49	HAL89
Word Perfect	Symphony	Unlock Masterkey95	Lotus 1-2-3 Ver. 2.01 295
Word Perfect Executive Call		XTree Professional 61	Lotus Manuscript 309
Word Perfect Library Call	ACCOUNTING		Lotus Report Writer
Wordstar Pro Pack 4.0 Call	ACCPAC Easy\$49	ACCESSORIES	MS Excel
Wordstar 2000 Plus Personal 205	Bedford Accounting 139		Multiplan 3.0 (Microsoft) 111
1101d0td1 20001 1d01 010011d1 200	Computer Associates Call	Copy II Option Board Deluxe \$99	PFS Professional Plan
DECUTOR BURLICUMO	DAC Easy Accounting53	Masterpiece <b>79</b>	Quattro
DESKTOP PUBLISHING	DAC Easy Payroll	Masterpiece Plus 92	Supercalc 4
Newsmaster II\$39	In-House Accountant 105	Masterpiece Remote 107	Twin Classic
Pagemaker	One Write Plus 2.0	MousePad by Mousetrac 9	VP Planner
PFS: First Publisher	One Write A/R, A/P, Payroll <b>117</b> Time Slips III <b>109</b>	Summasketch 12 × 12 Plus 359	VP Planner Plus
Ventura Publishing 475	1 III I G OII PS III	Carrilla Chotor IL A IL I Ido	vi i lalliloi i luo





of the Direct Marketing Association Inc.

- No Charge for VISA and Mastercard
- We Do Not Charge Your Card Until Your Order is Shipped You Pay the Ground Shipping \$6.00 (except Alaksa and Hawaii) We Pay the Air Difference
- Free Air applies ONLY to orders up to 10 lbs. & Over \$50. Add 5% for C.O.D. Orders
- All products carry only manufacturer's warranties. We do not honor guarantees, rebates, trial period priviledges or promotional programs offered by manuafactures.

- No APO, FPO, or international orders, please.

  Call before submitting P.O.'s Ask for National Accounts
- Personal and Company Checks Will Delay Shipping 3 weeks
- Prices, Terms & Availability Subject to Change Without Notice



ORDER LINE

DOING BUSINESS SINCE 1980 A DIVISION OF CW MARKETING

PRINTERS	
Alps	
Allegro	
ALQ224E599	
ALQ318	
ALQ324E	
2418	
2424	
Other Models	
AST Turbo Lazer	)
Citizen Printers	_
120D	
180D165	
MSP 40	
MSP 45	
MSP 55	-
Premier 35	
Tribute 124 Cal	
Diconix 150	
300	
Epson Printers Cal	
Hewlett-Packard	٠,
Desk Jet	9
Lazer Jet Series II1805	
Paint Jet	
NEC	-
P2200	5
P5200	
P5300	
Other Models Cal	
OkidataCal	ı
320	
390	
Lazerline 6	
Panasonic	
1080 I M2	9
1091 I M2	9
3131	5
3151	
Lazer 4450 1635	5
Star MicronicsCal	I
Toshiba	
321 SL	
341 SL	)

#### **DISK DRIVES**

Bernoulli Box	
10 Meg	\$889
20 Meg	1255
40 Meg	1559
Beta Ext	
Beta Int	. 775
Seagate	
20 MG w/WD Controller	
251-1	
AT 40 MEG Full Height	
Other Models	. Gaii
Teac	
1.2 MEG AT	
Floppy F55 BR	79
Toshiba	
3.5 Dr 720K	
3.5 Dr 1.4MB	. 105
HADD GADDG	
HARD CARDS	<b>^</b> -0-
Plus 20 MG	
Plus 40 MG	. 659
VEVDOADDO	
KEYBOARDS Keytronics	
Keytronics	\$119
Keytronics KB5151	
<b>Keytronics</b> KB5151 KB5153	. 149
Keytronics KB5151	. 149
<b>Keytronics</b> KB5151 KB5153	. 149
Keytronics KB5151 KB5153 KB101 MONITORS	. 149 85
<b>Keytronics</b> KB5151 KB5153 KB101	. 149 85 \$130
Keytronics KB5151 KB5153 KB101  MONITORS Amdek 410	. 149 85 \$130 . 149
Keytronics KB5151 KB5153 KB101  MONITORS  Amdek 410 432	. 149 85 \$130 . 149
Keytronics KB5151 KB5153 KB101  MONITORS  Amdek 410 432 V210A	. 149 85 \$130 . 149
Keytronics KB5151 KB5153 KB101  MONITORS  Amdek 410 432 V210A NEC	\$130 . 149 85
Keytronics  KB5151  KB5153  KB101  MONITORS  Amdek 410  432  V210A  NEC  Multisync II  Multisync Plus  Multisync XL	\$130 85 \$130 149 85 585 . 899 2069
Keytronics  KB5151  KB5153  KB101  MONITORS  Amdek 410  432  V210A  NEC  Multisync II  Multisync Plus  Multisync XL  Monographic System	\$130 \$149 85 \$130 149 85 585 . 899 2069 1299
Keytronics  KB5151  KB5153  KB101  MONITORS  Amdek 410  432  V210A  NEC  Multisync II  Multisync Plus  Multisync XL	\$130 \$149 85 \$130 149 85 585 . 899 2069 1299
Keytronics  KB5151  KB5153  KB101  MONITORS  Amdek 410  432  V210A  NEC  Multisync II  Multisync Plus  Multisync XL  Monographic System	. 149 85 \$130 . 149 85 585 . 899 2069 1299 . Call
Keytronics KB5151 KB5153 KB101  MONITORS  Amdek 410 432 V210A NEC Multisync II Multisync Plus Multisync XL Monographic System Other Models	\$130 . 149 85 \$130 . 149 85 585 . 899 2069 1299 . Call . 485
Keytronics KB5151 KB5153 KB101  MONITORS  Amdek 410 432 V210A NEC Multisync II Multisync Plus Multisync Plus Multisync XL Monographic System Other Models Princeton Ultrasync Samsung	\$130 \$130 \$149 \$85 \$85 \$89 2069 1299 Call \$485 Call
Keytronics KB5151 KB5153 KB101  MONITORS  Amdek 410 432 V210A NEC Multisync II Multisync Plus Multisync Plus Multisync XL Monographic System Other Models Princeton Ultrasync	\$130 \$130 \$149 \$85 \$85 \$89 2069 1299 Call \$485 Call
Keytronics KB5151 KB5153 KB101  MONITORS  Amdek 410 432 V210A  NEC  Multisync II Multisync Plus Multisync XL Monographic System Other Models  Princeton Ultrasync  Samsung  Sony Multiscan (1303)	. 149 85 \$130 . 149 85 585 . 899 2069 1299 . Call . 485 Call

1490 . . . . . . . . . . . . . . . . . . 609

Uninterruptible Power Source ...

#### **BOARDS**

AST	
Hot Shot\$359	
Six Pack Plus115	
Xformer545	
3G + II	
Other Models Call	
ATI	
EGA Wonder	
VIP	
Hercules	
Color Card	
Graphics Card Plus 170	
Incolor	
Intel	
Inboard 386 PC 935	
Inboard 386 w/cable 1029	
4020 <b>325</b>	
80287-6	
80287-16 <b>555</b>	
Orchid	
Designer VGA 299	
Tiny Turbo	
Twin Turbo	
VGA 220	
Paradise	
Autoswitch 350	
VGA +	
VGA Professional Call	
Video-7	
VGA 269	

**TERMINALS** 

Wyse

COMPUTERS
AST
Model 80
Model 140
Model 340
Model 390
Other Models Cal
NEC
Multispeed EL II1495
Toshiba
T-1000
T-1200F
T-1200H
1200FB 1699
1200HB
T-3200
T-5100
Wyse
386
Zenith Supersport/2 1655
Supersport 20 MG 2479
Supersport 286/Model 2 3445
MODELLO
MODEMS
Hayes
1200
1200B
2400B 385
Prometheus
1200B w/Software <b>75</b>

2400B w/Software . . . . . . . . . 129 Other Models . . . . . . . . . . Call

Courier 2400 . . . . . . . . . . . . . . . . . 289

HST 9600 ......**635** 

**US Robotics** 

AIR EXPRESS SHIPPING You Pay The Ground Shipping

We Pay The Air Difference

To Place an Order: 1-800-528-1054

Order Processing (602) 944-1037 To Follow Up on an Order: (602) 944-2552 10:00 a.m-3:00 p.m. Mon.-Fri.

Zenith

- Order Line Hours: Monday-Friday 7:00 a.m.-6:00 p.m.
- Saturday 9:00 a.m.-1:00 p.m · We Do Not Guarantee Machine Compatibility

#### Mailing Address:

8804 N. 23rd Avenue / Phoenix, Arizona 85021

ORDER LINE 800-528-1054

BASIC calls to the port address produce nothing on OUT instructions, and INP instructions seem to indicate that the bus is still "floating." It's as though the port address is not being decoded. I have limited test equipment, but supply voltages seem correct on the card. I swapped all duplicated components with the old working card from the TRS-80, which continues to work, leading me to believe that the components are fine. I've even checked the point-to-point wiring I used on the project; nothing seems amiss.

Since this is my first (and only) project on the PC-bus, I'm not sure about the logic I used. I suspect I may be overlooking some glaring design error. When I first tried the circuit, I didn't decode the AEN (address enable) line. The computer failed to boot properly, which showed me the importance of that line. Are there any other important things I need to consider?

Victor H. Klein II Newton, PA

Debugging logic at long range is always a little tricky, particularly if you don't have a scope to see what's going on. Without going back through the specs again, I bet that old speech generator just can't keep up with the new bus speeds. Probably the best way to get your circuit working is to hitch it to a parallel port where it's isolated from the bus and you can use a voltmeter to check the voltage levels.

The idea is fairly simple: The data inputs come from the printer data outputs, the WR signal is the printer's strobe, and the INTR bit goes back into the printer's BUSY line. In your case, you can use one of the printer port's control outputs to directly select which ROM bank to use. See table 1 for a diagram of the connections.

**Table 1:** Port connections for MM54104.

Printer port pin	Description
1	WR to MM54104 pin 1
2	D0 (least significant bit)
3	D1
4	D2
5	D3
6	D4
7	D5
8	D6
9	D7 (most significant bit)
11	INTR from MM54104 pin 6
17	ROM select to LS139 pin 3
18	Logic ground

Remember to disconnect your existing circuitry from the pins that connect directly to the printer port. You'll also need to come up with a power supply, but a simple wall transformer with a 9- or 12-volt DC output will suffice. Wrap a box around the whole affair and stick the speaker on top.

The next trick is to figure out the printer port address. The fastest and least ambiguous way is to use DEBUG, which is an experience everyone should have at least once. Fire up DEBUG, type D40:8L6, and press the Enter key. You'll see something like this:

0040:0008 BC 03 78 03 78 02

Each pair of hexadecimal numbers after the address corresponds to a printer port address. The above string of pairs shows three printer ports: LPT1 uses 03BCh, LPT2 uses 0378h, and LPT3 uses 0278h. Your system addresses may differ, but the ports are always LPT1, LPT2, and LPT3, in that order. Any ports that aren't installed will be 0—you can't use such ports for output.

Decide which printer port you want to use, and write down its address. Most people use LPTI for a real printer, so you'll probably want to use LPT2 and LPT3. Buying a printer card just for the speech system might be a good idea if you've got only one now. (I'm pretty sure the Tandy 1000 will take a standard printer card.)

Let's suppose you set up the address and word number like this (I haven't checked this BASIC code out, but it should get you started):

MMPORT = &H0278 MMWORD = 0

Then, to get the system to say the word, use

OUT MMPORT, MMWORD OUT MMPORT+2,1 OUT MMPORT+2,0

The ROM banks are selected by bit 3 in port MMPORT+2, so to select the other bank, use MMROM = 8, and say the word using

OUT MMPORT, MMWORD OUT MMPORT+2,1+MMROM OUT MMPORT, MMROM

I'll avoid telling you which bank is which, because that bit gets inverted at least once between BASIC and the decoder. The odds are that I'll be wrong no matter what I say.

To check the status bit and loop until it's 0, use

1000 IF INP(MMPORT+1) AND &H80 GOTO 1000

There's also a 50-50 chance I've messed up the BUSY bit, so if that gives bizarre results, try checking for a 0 bit instead of a 1 bit. The same logic applies if you write the code in Pascal, C, or assembly language: Put the word number out to the port, then toggle the strobe bit. All the usual PC languages can handle direct port I/O, so you shouldn't have any trouble.—Steve

### Printing in Reflected Type Dear Steve,

encountering the characters.

I am looking for a program that will enable me to print a page of text (eventually with some pictures) in reflected type (using a laser printer or dot-matrix printer). I need reflected type because the output is printed on a particular type of film that is exposed afterward. Currently, my colleagues and I simply print

If the type were reversed, we could place the film right, and since the light would pass through the film before encountering the characters, no distortion would occur.

the usual way and reverse the film after

I've sent inquiries to several CAD firms and have been told that their programs wouldn't be able to handle text, because of problems with "reference points"—whatever that means.

Desktop Publishing packages like PageMaker and Ventura can't help me out, either, at least not here in Belgium. Have you ever heard of a software program that could help me?

Paul Verbinnen Brussels, Belgium

I have not seen software that will print reflected type in a way you need. I have seen ads for graphics programs that do this in a limited way, but it appears to me that you need two things: a program that will transmit the characters to the printer in reverse order, and a set of reversed fonts for your printer. Since you are worried about the distortion caused by transmitting the image through the film, I assume you won't be satisfied with the relatively low-quality fonts you could make and download to an Epson or compatible printer. Even the 24-pin models only accept characters defined in an 18 by 24 dot, about half the number available in laser printers.

continued



#### We've got a whole new family of tape backup systems.

Whether you've got an IBM, a compatible, or a Macintosh, you can count on Tallgrass. We back you with all the storage capacity you could ask for, plus all the features, all the support, and all the speed you'll ever need. And we make it easy to protect your valuable data. Since all operations are automatic and unattended, you can just set it, and forget it.

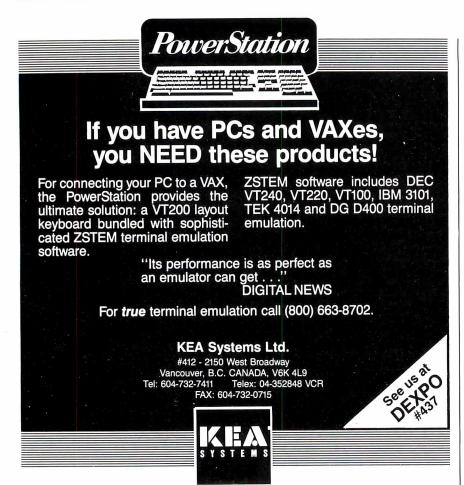
#### Best of all, we stand behind our products with the industry's only 3-year warranty.

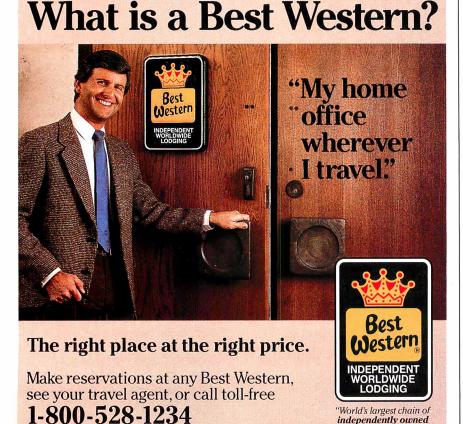
But there's one other reason why so many more people are asking for Tallgrass. It's because the competition is asking so much more for their products. Call 1-800-TAL-GRAS. Or write to: Tallgrass Technologies, Inc. 11100 West 82nd St. Overland Park, KS 66214

Let Tallgrass start backing you up.



When it's worth saving, it's worth Tallgrass





independently owned

and operated

hotels, motor inns and resorts"

Printing the characters in reverse order from a straight text file is easy: I'll get to that later. Reversing the characters is the task that will require work. I don't know of any software that can do this. There are some font-editing programs available that might help. Here are some that work with bit-mapped fonts:

SoftCraft Font Editor SoftCraft 16 North Carrol St., Suite 500 Madison, WI 53703 (800) 351-0500

FontGen IV VS Software 209 West Second St. Little Rock, AR 72216 (501) 376-2083

Publishers Type Foundry **ZSoft** 1950 Spectrum Cir., Suite A-495 Marietta, GA 30067 (404) 428-0008

An alternative to creating reversed fonts using a font editor is to write a program that reverses an existing font by reversing the order of the bytes. For example, an R in an 8 by 9 dot-matrix printer download font would be stored as in table 2a. Table 2b also shows the result after swapping bytes so that byte I becomes byte 8, 2 becomes 7, and so on.

Table 2: Reversing the font definition for an "R." (b) (a) 12345678 12345678 byte -> 01111100 00111110 01000010 01000010 01000001 10000010 01000010 01000010 01111100 00111110 01000100 00100010 01000010 01000010 01000001 10000010 00000000 00000000

Reversing the order of bytes is simply a matter of reading them into an array and writing them back out to a new file in reversed order. That is, fill the array from 1 to 8, and write the bytes from 8 to 1. I'm not sure that laser printer bit-mapped fonts are stored the same way, but if they're not, the operation of reversing the bits is still possible, but more complicated.—Steve ■

# "An exceptional value Tom Badgett, PC Clones

"I was impressed. It wins the costeffective award."

John Dvorak, PC Magazine

"This program has all the features and capabilities of money management programs costing 10 times as much."

Leonard Hyre, PCM Magazine

We appreciated those kind words. They helped make MONEYCOUNTS® 4.0 one of today's most popular accounting/money management programs for home and business. But we couldn't leave well enough alone. So we're introducing new

### MONEYCOUNTS 5.0

...an unbelievable buy at just \$29!

MONEYCOUNTS® 5.0 balances your checkbook... prepares your budget... manages your cash, checking, savings, credit cards... prints 5 types of financial statements including net worth...3 types of inquiry reports... general ledger, accountant's trial balance, and graphics. Its fast financial data base handles up to 999 accounts and 100,000 transactions a year.

MONEYCOUNTS® 5.0 is a CPA-designed money management/accounting system you can use for home or business. It's easy to use, requires no accounting knowledge, is menu-driven with on-line help, has a fast financial calculator, works with monochrome or color monitors, comes with a printed manual and is not copy protected.

SAME DAY SHIPPING. Order today and own MONEYCOUNTS® 5.0 for only \$29! Add \$5 shipping/ handling (outside North America, add \$10). Iowa residents please add 4% sales tax.



375 Collins Road NE Cedar Rapids, IA 52402

#### MONEYCOUNTS°5.0 now also...

- · prints any type of pin-feed check and updates your records automatically
- estimates your 1988 income tax
- analyzes financing options, savings programs...computes interest rates, loan payments...prints amortization schedules
- manages mail lists—zip and alpha sorts—and prints labels and index cards
- provides password protection, fiscal year support, and pop-up notepad.

VISA, MASTERCARD & COD ORDERS CALL

(In Canada, call 319/395-7300)

Cedar Ra	Tusona Technology ns Road NE apids, IA 52402	\$2	29 + \$5 s	NTS ION 5.0
STATE/ZIF	ZIPPHONEPHONE			
CARD #_			EXP. DA	TE
No. of Copies	Product		Price Each	Total
	MONEYCOUNTS® 5.0 (Nec compatible computer, at memory, DOS 2.0 or more drives or hard disk)	least 256k	\$ 29.00	
	Shipping	& Handling	\$ 5.00	\$ 5.00

# DAZZLING PERFORMANCE.



#### '286/SS

# COMPLETE 12MHz '286 WITH 32MB HARD DRIVE ONLY \$1295.00

- 80286 CPU, 8/12.5 MHz Dual Speed, Keyboard Selectable.
- Zero-Wait State RAM, 512K expandable to 4MB on the motherboard (16MB System Total).
- 32MB Hard Drive, 1.2MB Floppy Drive.
- *Ultra high speed* Hard/Floppy controller. 1:1 interleave, 800 KB/sec transfer rate.
- High Res 12" Amber Display with Tilt and Swivel Base. Compatible graphics controller.
- ZEOS Enhanced Keyboard, Pleasant Tactile/Click Feel.
- Serial and Parallel Printer Ports.
- Clock/Calendar with Battery Backup.
- 6-16 and 2-8 bit expansion slots.
- 80287 support, up to 12 MHz.
- Space Saver Case with Security Lock, LED indicators.

#### 12MHz, 16MHz and 20MHz '286 HARD DRIVE SYSTEMS

As high as 20MHz! Dazzling performance is yours with one of these high performance full size ZEOS '286 Systems.

Each comes *complete* with our standard features including drives, monitor, high speed controller, etc. Our full size case features room for up to 5 half-high drives, two of which are internal. Incredible values.

- ■286/12—Complete 12.5MHz System with 512K of Zero-Wait RAM, High Speed 32MB, 33ms Hard Drive and all the standard ZEOS goodies. ONLY \$1395.00
- 286/16—Complete 16MHz system with 1MB RAM on board and High Speed 32MB Hard Drive. Faster than a '386 16MHz when running 16-bit software!

#### ONLY \$1895.00

■ **286/20**—At 20MHz, it's the fastest. Complete with our 32 MB, 33ms Hard Drive and *1MB* RAM. This is what Dazzling Speed is all about. **ONLY \$2095.00** 



'286/FS

## DAZZLING PERFORMANCE. INCREDIBLE PRICES.

Can you believe it? Yes, you can!

We've proven it to thousands and we would like to prove it to you. ZEOS® systems are sold *complete*, ready to plug in and fly right out of the box. And the quality

and prices are incredible.

How is it possible? Because your ZEOS computer comes to you *factory direct*, fully assembled, burned-in and tested in our own laboratories. Every system is built to order. Custom built actually, right to your own specifications.

And our quality and performance are second to none.

We don't just say it. We guarantee it. That's why your new ZEOS system comes with a Full One Year Limited Warranty and our 30 day Full Refund Satisfaction Guarantee.

So pick out your dream

# INCREDIBLE PRICES.



'386/DT

# COMPLETE 16MHz '386 DESKTOP WITH 32MB HARD DRIVE. ONLY \$2495.00 (20MHz add \$500)

■ Genuine 32-bit Intel 80386, 16 or 20MHz parts.

■ 1MB of RAM Expandable to 16MB.

■ 32MB, 33ms Hard Drive, 1.2MB floppy drive.

- *Ultra high speed* Hard/Floppy controller. 1:1 interleave, 800 KB/sec transfer rate!
- High Res 12" Amber Display with Tilt and Swivel Base. Compatible graphics controller.
- 101 Key ZEOS Tactile Click keyboard.
- Serial and Parallel/Printer Ports.
- Clock/Calendar with Battery Backup.
- 2-32, 4-16 and 2-8 bit slots.
- 80287 and 80387 support.

## COMPLETE '386 VERTICAL SYSTEM. 64MB DRIVE!

# ONLY \$2995.00 (20MHz add \$500)

Acknowledged worldwide as the highest performance value anywhere. Same great standard ZEOS features found on our other complete systems plus:

- 64KB Zero-Wait CACHE using 64K of SRAM.
- 1MB of 32-bit RAM system expandable up to 16MB.
- 64MB Seagate Hard Drive.
- 80287 and 80387 optional.
- Heavy Duty Vertical Case.

#### Ask about our 25MHz systems too!



'386/V

machine and order it now with confidence. Dazzling performance and incredible prices await you. *Guaranteed*. Order now by calling 800-423-5891.

Other ZEOS Options Include:

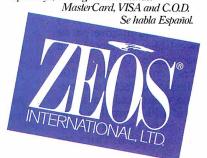
■ Basic Configurations: Call for prices on systems without drives, etc.

■ EGA/VGA Upgrades. 14" EGA color monitor with EGA card, add \$495. 14" VGA system, add only \$695

■ High Capacity Drives. Many other drives and options are available. Call Toll Free for details, 800-423-5891

# ORDER NOW TOLL FREE 800-423-5891

FAX Orders Dial: 612-633-2310 In Minnesota Call: 612-633-4591 530 5th Ave. NW, St. Paul, MN 55112 Open days, evenings and weekends.



 $ZEOS\ International, Ltd., 530\ 5th\ Avenue, NW, St.\ Paul, MN\ 5512.\ ZEOS\ is\ a\ publicly\ traded\ company;\ MPLS/ST.\ PAUL\ Local\ OTC.$ 

## **BOOK REVIEWS**

#### The Conquest of the Microchip

by Hans Oueisser

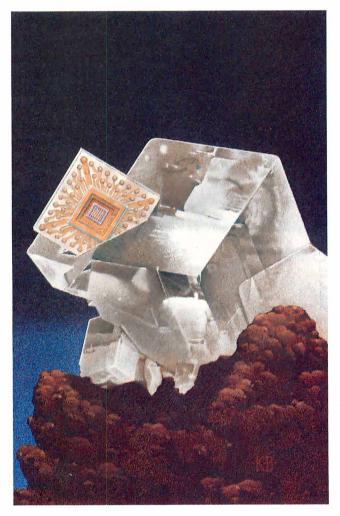
Harvard University Press, Cambridge, MA: 1988, 272 pages, \$24.95 (hardcover)

Reviewed by Hugh Kenner

N ature's wonders include rocks you can see through-pieces of clear quartz. But how did they get here? Our forebears guessed that these clear rocks had once been chunks of ice that mysteriously survived in an altered state. So, borrowing Homer's word for clear ice, krystallos, our ancestors taught us to speak of crystals. These had something to do with symmetry; that was soon obvious. Look at the orderly shapes salts will assume as they "crystallize" out of water.

By 1723, crystallography was a name for a highly mathematical science. And since order seems a special case in a random universe, what better window onto future happenings than a seer's crystal ball? (No, I'm not being facetious; that was really the crystal ball's theme.)

Crystalline wonders kept multiplying. Around 1630, in Bologna, Italy, a shoemaker/ alchemist named Casciarolo chanced to make heavy stones glow with cold light. ("He had reduced barium sulfate to a sulfide, but that would not be understood for centuries, says author Hans Queisser.) What he had discovered we now call phosphorescence and fluorescence. Today, "phosphors" coat an annual 100 million square feet of new television tubes, and glass gets treated with crystallite powder to make a billion fluorescent tubes besides. That's one



way to indicate how much seeming magic we subject to routine control.

We can do that because we've merged quantum theory with solid-state physics, and so we've worked ourselves free of an era when tinkerers, in the manner of Casciarolo, kept chancing on curious effects no one could explain. A main site of that crucial merger was Goettingen University, where Queisser got his education. Later, he worked with William Shockley in Silicon

Valley. At present, he directs the Max Planck Institute for Solid State Research in Stuttgart, West Germany. Such credentials make his Conquest of the Microchip very much an inside story.

The book could not be more engagingly written. Its narrative commences with Guglielmo Marconi, in 1914, disliking the fact that his ironfiling "coherer" (chanced upon in 1890 and not at all understood) was an unreliable foundation indeed for the coming wireless industry. The future, it seemed, lay in a German discovery, the crystal detector, which wasn't understood, either. How did it manage to defy Ohm's law? And why did some crystals work and others not?

In fact, so mysterious was crystal behavior that Marconi's industry would soon be heading off on a long, clumsy vacuum-tube detour. Tubes used brute force; to get any result at all, you had to heat a filament red-hot. If that used up Niagaras of power, at least the tubes were reliable until they burned out-and they always burned out. The men who fired up the ENIAC computer (a base-10 machine, incidentally) could never really guarantee that all 18,000 tubes were functioning at once. The one thing certain was the electric bill, based on a steady flow of 150 kilowatts.

Crystal radios did stay around, cheap toys for attic tinkerers. I remember buying a kit for about a dollar. Today I'm typing these words on a computer, vastly more powerful than ENIAC, that curbs ENIAC's appetite for wattage by a factor of 1000-for the crystal did return.

Its comeback began at post-World War I Goettingen, where Richard Pohl, unable to

#### ALSO REVIEWED

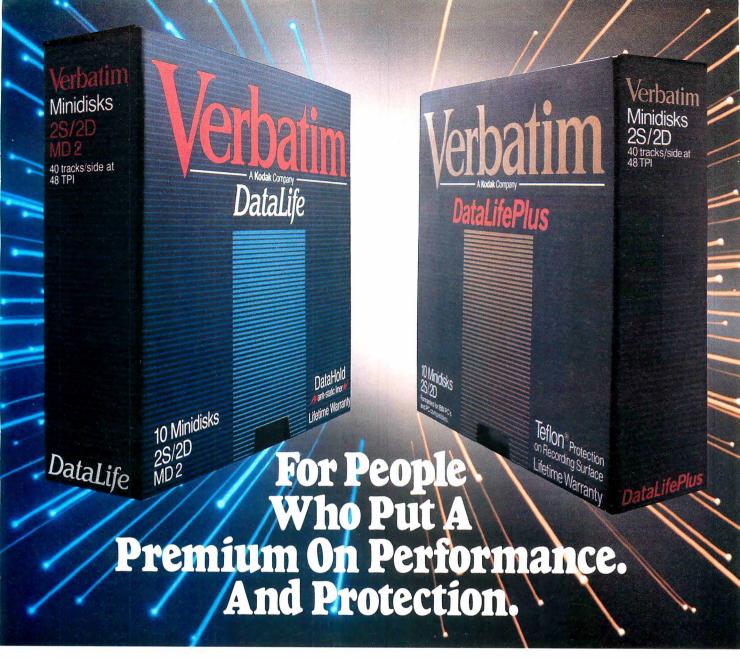
An Introduction to Solid Modeling

Programs and Data Structures in C

C as a Second Language

Perceptrons

BASIC Mathematical Programs for Engineers and Scientists



The more invaluable your data is to you, the more you'll value Verbatim® floppy disks. Because when it comes to high performance and data protection, Verbatim has the winning combination no other floppies can copy.

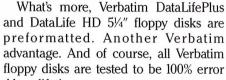
You expect high performance from Verbatim, so it's no wonder that all our DataLife<sup>®</sup> floppies are engineered to perform an average of 50 million revolutions. That's fifteen times the industry standard.



Setting new standards in data protection is another Verbatim advantage. After all, nearly 50% of all computer users have experienced data loss. Which directly translates into lost time, productivity and money. That's why Verbatim offers advantages like DataHold  $^{\text{\tiny M}}$ and DataHold II anti-static liners. So static charges are dispersed before they ever have a chance to build up.

For the world's ultimate data protection, DataLifePlus™ floppies have an exclusive DuPont Teflon® coating. So fingerprints, coffee, soft drinks, and even greasy foods can be easily wiped from the recording surface. To virtually

eliminate data loss.



free and are backed by a lifetime warranty.

erbatim

Verbatim data cassettes and cartridges, 8", 5¼" and 3½" diskettes. The only clear choice for people who put a premium on performance and protection.

For more information on the full line of high quality Verbatim products, call 1-800-538-8589.

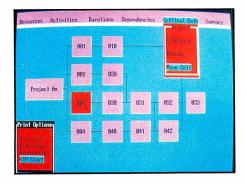
® Teflon is a DuPont registered trademark.



DOING MORE FOR THE DATA PROCESS™

### **FULL POWER** AT YOUR FINGERTIPS.

Discover two Worlds with the advanced screen generating Facility for "C" Programming Environments, STAGEHAND, and its comprehensive demo facility **PLAYWRITE**.



#### Create your screens with STAGEHAND:

- · Full screen editor.
- User definable edit function keys.
- Set multiple color text & prompts.
- Define window borders, size and position.
- Create full screen & context sensitive help.
- Extensive printouts for documentation.
- Define valid function keys, pageup/ pagedown.
- Define internal/external help screens.
- Idle and active input sequence.
- Define default prompt values.
- Full input field definitions including:

Protected Must Fill

Auto Clear Keystroke Edit Upper Case Lower Case

Cursor Type Cursor Positioning Data Types Sequencing Auto Move

#### Full runtime support with STAGEMANAGER:

- Full library support routines w/source code.
- Multiple overlapping windows.
- Scrollable regions.
- Auto scrolling windows.
- User idle time routine support.
- User prompt routine support.
- User keystroke routine support. User function key routine support.
- User pageup/pagedown routine support.
- · Hot key to user printer handler.
- · Auto screen timeout.

#### Powerful demo generating PLAYWRITE:

- Create quick display demos.
- · Create quick interface demos.
- Create powerful full featured intensive demos.

#### Total product support for:

- Microsoft 4.x, 5.x, Quick C, Turbo C.
- No royalties or runtime fees
- FREE updates to registered users.
- FREE telephone support.
- FREE STAGEMANAGER source code.
- Comprehensive manual including library routine definitions and examples.

### SPECIAL PACKAGE PRICE \$ 199.00! Call for FREE Demo Disk.

TO ORDER CALL 1 800 - DATACODE OR (516) 331-7848 C.O.D. or AMERICAN EXPRESS.

#### DEALER INQUIRES WELCOME!

LOOK FOR MS/OS2, UNIX AND VAX VERSIONS THIS SUMMER!

DATACODE INCORPORATED

1085 ROUTE 112, PORT JEFFERSON STATION, N.Y. 11776

get liquid air, had to forgo experiments with the tubes that liquid air could help evacuate, and wryly turned to crystals as second-best. Then a lab mistake that shattered a costly diamond sent him after techniques for growing pure artificial crystals. By 1930, much mystery had been penetrated. Anomalous crystal behavior, wanted and unwanted alike, proved to turn on the presence of minute impurities—local irregularities in the lattice. We now "dope" our lab-grown crystals with the irregularity that gets just the effect we seek.

In World War II Britain, the cat's-whisker crystal detector, long discarded by the radio industry, proved just the thing for ultra-short-wave radar. That brought germanium on-stage, and the pointcontact transistor (Shockley et al. at Bell Labs, 1947) was essentially a germanium crystal with two cat's whiskers. Finicky cat's whiskers plagued it with reliability problems, and though the junction transistor soon got rid of whiskers, in 1955 the military was still wishing that better than a quarter of the units delivered might fall within spec.

Next, silicon replaced germanium (I'm hurrying through this). Soon, companies that had spun off from Shockley's (who had long since left Bell Labs for California) were into microprocessors, microchip circuitry.... You've probably heard much of this information presented before, but Hans Queisser's version is more vivid and insightful.

By halfway through his book, Queisser is orchestrating so many themes with such dexterity that it's breathtaking. Something that he never forgets is the sociocultural ground bass—the way, for instance, German science, remembering the coercions of two wars, kept aloof from industry and practice. Then there's the invaluable Western tradition of "skepticism, selfawareness, and independent work," which produced the great breakthroughs of the 1940s and 1950s but would later erect barriers, unknown in Japan, "between the universities, the factories, and the research laboratories." Consider, lastly, the Japanese genius for basing mass production on mass experiments, testing "every imaginable combination of manufacturing processes"and investigating 'every type of foreign admixtures in the silicon crystal." Western observers at first found that amusingly antlike. Later on, they got nervous, rightly.

For already, by the 1960s in Silicon Valley, says Queisser, "a field in which a few individuals had paved the way was turning into the anonymous work of a number of experts. Every form of technology takes a similar route when it leaves the laboratories for the factories." In Japan, he also notes, "They do not consider basic research and applications as opposites. In their terminology, the opposite of 'basic' is not 'applied,' but simply 'not basic'; the opposite of 'applied' would be something like 'not applicable.' " This last they have learned to shun.

Just such "impurities" as make junction transistors work also create what was noticed far earlier: the colors of gemstones. When nature does anything to catch our attention, it's by generating something we can observe. And the line between "observable" and "applicable" is thin, each being an interruption of the bland. Save for our long pursuit of applicability, we'd still be surviving by smashing clamshells with rocks.

Man's microcosm once, Queisser concludes, was simply Man, a vexed model of universal harmonies. Today, that microcosm is the silicon crystal lattice, which we're probing for "the secrets of creation and destruction, as well as harmony and symmetry.' Now it is "the macrocosm of

continued

# UTERS FROM

serve the entire country was a schonest, hard working, well educated people, committed to succeeding and growing in the highly competitive micro-computer market.

Galeway 2000 is a full-service and support organization that realizes the key to our success lies in a satisfied customer base.

One look at the configurations we have listed below and you will see that we have high quality equipment at incredible prices. We have many different configurations available as well as a complete line of software and peripherals. So call one of our knowledgeable salespeople for more information.

We look forward to doing busines with you, and establishing a long term business relationship.



#### 16 Mhz 286 EGA SYSTEM

80286-16 Processor 1 Meg 0 Wait State RAM 1.2 Meg Floppy Drive 1.44 Meg Diskette Drive 40 Meg Seagate ST251 Samsung EGA Monitor w/Card 2-Parallel/2-Serial Ports 101 Key Enhanced Keyboard DOS 3.3 w/GWBasic 1 Year Warranty 30 Day Money Back Guarantee

\$2295 **a**c



#### Mhz 386 VGA SYSTEM

386 Processor Running at 20Mhz

Meg 60 NS Ram (Expandable to 8 Megs)
.2 Meg Floppy Drive
.44 Meg Diskette Drive

80 Meg Seagate ST4096 (28MS)

1 to 1 Interleave Controller

Samsung Multisynch Monitor

**EVEREX EVGA Board** 

2-Parallel/2-Serial Ports
101 Key Enhanced Keyboard
Tower Case w/275 Watt Power Supply
80287 and 80387 Sockets

DOS 3.3 w/GWBasic

1 Year Warranty

30 Day Money Back Guarantee

\$3795.00 Call For 25 Mhz Option



Gateway 2000 • P.O. Box 2414 • Sioux City, IA 51107 800-233-8472/712-255-7899

Due to the volatility in the DRAM market, all prices are subj

society" that "seeks the har-

mony of the microcosm of the

atom." And that is nothing

less than the present state of

our ages-long romance with

An Introduction to Solid

Modeling by Martti Mäntylä,

Computer Science Press,

Rockville, MD: 1988, 401

pages, \$42.95. Plenty of

books will teach you about

computer graphics, particu-

larly about manipulating and

displaying images. Textbooks

abound describing algorithms

for hidden-line and hidden-

surface removal. Journal arti-

cles will further direct you to

esoterica regarding the inter-

action of light with material objects to produce shadows,

reflections, and refractions

(ray tracing). And conference

proceedings will give you the

latest techniques on modeling

solid-surface properties, such

techniques for describing the

shapes of objects is more difficult. Clearly, graphics pro-

grammers need good ways to

represent shapes. Typically,

however, procedures for ren-

dering an image on-screen re-

quire a preexisting description

of the shape as "input." In

short, discussions of represen-

tation issues are much harder

to come by than discussions of

On the other hand, learning

as color and texture.

**BRIEFLY NOTED** 

ordered crystals.

#### -IBM PC® COMPATIBLE-SINGLE BOARD COMPUTER

Quark/PC°+

4" × 6"



quantity one

- Low Power Less than 3 Watts
- Optional on-board Video LCD Driver
- Ideal for any PC compatible OEM product which is not a personal computer

Includes: 1. Powerful V40® CPU (Faster than a PC) 2. Math Co-Processor Socket 3. 5 Volt Only Operation (3 watts) 4. Speaker Port 5. Keyboard Port 6. Parallel Printer Port 7. PC Bus 8. PC Compatible BIOS ROM

On board Options Include: 1.5 Mode Video Controller Option (Monochrome, Hercules® Graphics, CGA, High Res CGA, LCD Driver) 2. Floppy Disk Controller (3.5"/15.25", 360K/720K/1.2 MB) 3. SCSI Bus Interface (Hard Disk etc.) 4. Up to 768K RAM 5. Battery-Backed-up Real-Time-Clock 6. 2 Additional RS232C Serial Ports To order or enquire call us today.

Megatel Computer Corporation (416) 745-7214 FAX (416) 745-8792 174 Turbine Drive, Weston, Ontario M9L 2S2

U.S. Address: 1051 Clinton St., Buffalo, N.Y. 14206

Distributors:

DISTRIBUTORS:

Germany: V&C Computers (06071) 25666 FAX (06071) 5863 Italy and Southern Europe:

NCS Italia (0331) 256-524 FAX (0331) 256-018

U.K.: Densitron (0959) 76331 FAX (0959) 71017

Australia: Asp Microcomputers (02) 500-0628 FAX (02)500-9461 Quark is a registered trademark of F&K. Manufacturing Company, Hercules is a registered trademark of Hercules Corporation. V40 is a registered trademark of NEC Corp. IBM PC is a registered trademark of IBM Corporation.

\_ megatel :

### **QSET:** The Simple Approach to **Powerful Solutions.**

And simple means fast! Applications in use instead of in development. Applications completed when other system developers are still getting started.

QSET is the most productive approach you can take to I/O applications. Easy to learn, fast, and flexible. Combines the power of UNIX, Xenix, C, and any 3GL you choose for powerful, portable applications. Supports relational, hierarchical, and network database structures.

Built-in program logic insures data and system integrity: you can't build a bad application using QSET.

Find out more. Call 800-727-2072. Ask for our product brochure and our very attractive introductory pricing offer.



An Applications

OSET is a trademark of Business Management Data, Inc. UNIX is a trademark of AT&T. Xenix is a trademark of Microsoft Corporation.

AT is a trademark of International Business Machines Corporation.

Menu driven

No new language

AT type environment

Rapid prototyping

Multi-user

Data and system integrity

rendering issues. An Introduction to Solid Modeling remedies this deficiency significantly by focusing on a very important class of representational methods solid modeling. The book is at once comprehensive and accessible to readers without a strong background in com-

puter graphics.

The first section surveys the current techniques and presents topics such as boundary representations, curved surface patches, and volumetric methods like solid geometry and octrees. The second section describes in detail the author's own solid modeling

system, the Geometric Work-Bench.

The explication of this technique makes the book far more than just a roundup of existing knowledge. The Geometric WorkBench is capable of modeling polyhedrons. It employs a boundary representation of solids: It describes a solid object by describing each piece of the object's surface. Specifically, the program recognizes a polyhedron as a collection of flat faces. The complete solid model includes a description of each of the faces. Each face is a polygon and so can be specified by the list of straight edges that bound it and the list of vertices at which the edges meet.

Not every collection of polygons constitutes a valid solid model; the polygons must fit together in a way that leaves no holes and no overlaps. The Geometric Work-Bench guarantees a model's validity at each step of construction. This guarantee is the program's most important feature.

The system protects a model's integrity in two ways. First, the modeler stores geometrical and topological information separately. Geometry relates to dimension. The geometry of a shape specifies the position of each vertex, the length of each edge, and the size and orientation of each face. Topology relates to connectedness. The topology of a shape lists which edges meet at each vertex and which faces border one another. The topology therefore also tells whether all of a model's parts fit together in a sensible way. The program is able to more efficiently check integrity on one hand and to scale the size of the model on the other, because it deals with topology and geometry separately.

Second, the Geometric WorkBench restricts the users to a small selection of operators that provide them with the means to modify a solid model. Each application of an operator corresponds to one

continued

# Mainframe Power for your PC!

If you need or are accustomed to the throughput of a 32-bit mini, including any of DEC's VAX series, MicroWay has great news for you. The combination of our NDP compilers and our mW1167 numeric coprocessor gives VAX speed to your 386 PC! If you don't own a 386 PC, we provide a number of economical

PC and AT upgrade paths.

Many of our NDP Fortran-386 users are reporting turnaround times that are two to six times faster than their VAX. The exact times are a function of the VAX processor being used, the speed of the 386, the number of users being served by the VAX, and the coprocessor being used with the 386. There are currently over 400 developers using our NDP tools to port 32-bit applications. To help the 386/1167 engineering standard emerge, MicroWay is co-marketing several mainframe applications that have been ported by our customers. In addition, this ad

Dr. Robert Atwell, a leading defense scientist, calculates that NDP Fortran-386 is currently saving him \$12,000 per month in rentals of VAX hardware and software while doubling his productivity!

Fred Ziegler of AspenTech in Cambridge, Mass. reports, "I ported 900,000 lines of Fortran source in two weeks without a single problem!" AspenTech's Chemical Modeling System is in use on mainframes worldwide and is probably the largest application to ever run on an Intel processor.

Dr. Jerry Ginsberg of Georgia Tech reports, "My problems run a factor of six faster using NDP Fortran-386 on an mW1167 equipped 386/20 than they do on my MicroVAX II."

introduces the first of many utilities that will ease the porting of your favorite in-house programs. These include tools like NDP Plot. which provides CalComp compatible screen and printer graphics, and NDP Windows. MicroWay has mW1167 boards in stock that

run on the Compaq 386/20, IBM PS2/80, Tandy 4000, AT&T 6386, Acer 386/20, Everex Step 386/16(20), H.P. Vectra RS/16(20) and others. We now have a new board for the Compaq 386/20 which combines an 1167 with VGA support that is register compatible with IBM the "SlotSaver". It features an extended 800x600 high res mode that is ideal for 386 workstations.

Finally, we still offer the 16-bit software and hardware which made us famous. If you own a PC or AT and are looking for the best 8087/80287 support on the market, call (508) 746-7341 and we'll send you our full catalog.

#### **32-Bit Compilers and Tools**

NDP Fortran-386™ and NDP C-386™ Compilers generate globally optimized mainframe quality code and run in 386 protected mode under Phar Lap extended MS-DOS, UNIX, or XENIX. The memory model employed uses 2 segments, each of which can be up to 4 gigabytes. They generate code for the 80287, 80387, or mW1167. Both include high speed EGA graphics extensions written in C that perform BASIC-like screen operations.

- NDP Fortran-386™ Full implementation of FORTRAN-77 with Berkeley 4.2, VAX/VMS and Fortran-66 extensions.....\$595
- NDP C-386™ Full implementation of AT&T's PCC with MS and ANSI extensions....\$595

#### NDP Package Pricing:

387FastPAK: NDP Compiler, Phar Lap and 80387 Coprocessor 16 MHz: \$1299 20 MHz: \$1499

1167FastPAK: NDP Compiler, Phar Lap and mW1167 Coprocessor 16 MHz: \$1695 20 MHz: \$2295

Phar Lap Development Tools ..... \$495

NDP Windows™—NDP Windows includes 80 functions that let you create, store, and recall menus and windows. It works with NDP C-386 and drives all the popular graphics adapters. C Source: \$250 Library: \$125

 $\mathbf{NDP}\ \mathbf{Plot}^{\mathsf{TM}} - \mathbf{Calcomp}\ \mathbf{compatible}\ \mathbf{plot}\ \mathbf{pack-}$ age that is callable from NDP Fortran. It includes drivers for the most popular plotters and printers and works with CGA, Hercules, EGA 

NDP/FFT™ — Includes 40 fast running, hand coded algorithms for single and double dimensioned FFTs which take advantage of the 32bit addressing of the 386 or your hard disk. Callable from NDP Fortran or NDP C with mW1167 and 80387 support . . . . . . . . . . . . . . . . \$250 387FFT for 16-bit compilers . . . . . . . . . \$250

387BASIC™ — MicroWay's new 16-bit MS compatible Basic compiler that generates the smallest EXE files and the fastest running numeric code on the market . . . . . . . . . \$249

## MicroWay ® 80386 Support

#### **Parallel Processing**

Monoputer™

The world's most popular transputer development product runs all MicroWay transputer software using either a T414 or T800. The T800 processor has built-in numerics and provides performance comparable to an 80386 running at 20 MHz with an mW1167. The new 3L Parallel C and Fortran compilers makes this an especially attractive porting environment. Can be upgraded to 2 megabytes.

This board for the XT, AT, or 386 can be purchased with 2, 3 or 4 transputers and 1, 4 or 8 megabytes of memory per transputer. Two or more Quadputers can be linked together to build networks with mainframe power which use up to 36 transputers. One customer's realtime financial application has gone from 8 hours on a mainframe to 16 minutes on a system containing five Quadputers. . . . from \$3495

Transputer Compilers and Applications MicroWay offers Parallel languages for the

Monoputer and Quadputer.

MicroWay Parallel C . . . . . . . . . . . . . . . \$595 MicroWay Occam2 . . . . . . . . . . . . \$495 package targeted at transputer networks. Ideally suited to take advantage of the 6 Megaflop speed of the Quadputer.....\$1600 MicroWay Prolog Interpreter . . . . . . . . \$750

> Call (508) 746-7341 for our free catalog!

#### **Numeric Coprocessors**

mW1167™ — Built at MicroWay using Weitek components and an 80387 socket.
mW1167-16 \$995
mW1167-20 \$1595
mW1167/VGA-20 "SlotSaver" \$1995
8087 \$99
8087-2 \$145
80287-8 \$239
80287-10 \$279
80387-16 \$450
80387-20 \$675
80387-25 \$795
287Turbo-12 (for AT compatibles) \$450 Weitek components and an 80387 socket. 287Turbo-12 (for AT compatibles) ....\$450 DRAM . . . . . CALL (All of our Intel coprocessors include 87Test.)

#### **PC and AT Accelerators**

MicroWay builds a number of 8086 and 80286based PC accelerators that are backed up by the best customer support in the industry. Number Smasher™ (8087-10 & 512K) \$499 FastCACHE-286/12 MHz . . . . . . . . . . . . \$299 SuperCACHE-286/12 MHz ......\$399

#### **Intelligent Serial Controllers**

MicroWay's AT4™, AT8™, and AT16™ are the fastest 80186-based intelligent serial controllers on the market. They come with drivers for UNIX, XENIX, and PC MOS.

AT4 ... \$795 AT8 ... \$995 AT16 ... \$1295

#### **32-Bit Applications**

COSMOS-M/386 — SRAC's structural and thermal finite element packages for the 80386. when combined with an 80387 or mW1167. achieve mainframe speed and capacity. Turnaround times rival the VAX 8650 and are 6 to 15 times that of an AT . . . . . from \$995

PSTAT-386 — This mainframe statistics package has been used by government and industry for 20 years. The full version was ported. Requires 4 to 6 megabytes of memory: \$1495

NDP/NAG™ — Features a library of 800 engineering and scientific numerical algorithms.
Callable from NDP Fortran . . . . . . . . . . . . \$895



#### The World Leader in PC Numerics

P.O. Box 79, Kingston, MA 02364 USA (508) 746-7341 32 High St., Kingston-Upon-Thames, U.K., 01-541-5466 Australia 02-439-8400 Germany 069-75-1428

# When you want to talk computers...

#### **ATARI COMPUTERS**

800XL 64K Computer 84.99
130XE 132K Computer 139.00
520ST-FM RGB/Color Syst 789.00
1040ST Color System Call
SF1224 Color Monitor 329.00
XF551 Disk Drive (XL/XE)189.00



#### Atari 800XL & XF551 Disk **Drive & Software**

Includes: 800XL, 551 Drive, & Star Raiders, Missile Command, Asterioids, Defender, Qix.

#### **ATARI ST SOFTWARE**

#### AMIGA SOFTWARE

Absoft AC Basic
Aegis Development Animator/Images
Draw Plus
Sonix
Discovery Software
Marander II
Electronic Arts
Deluxe Video 1.2 89.99
Gold Disk Software
Pagesetter w/Text ed
Micro Illusions  Dynamic Cad
Dynamic Gau

#### **AMIGA SOFTWARE**

Mimetics
Amigen Gen Lock 159.00
New Tek Inc.
Digi-View 2.0
Digi-Paint
Sub-Logic Corp.
Flight Simulator II
Word Perfect Corp.
Word Perfect 199.00

#### **MACINTOSH PRODUCTS**



#### **OLYMPIA** NP-30 Mac 150 CPS \$339

Hard Drives
CMS
MacStack 60 899.00
Everex
40MB SCSI
40MB SCSI
PCPC
MacBottom HD45
Floppy Drives
Central Point
Magnum 800k209.00
Mirror Technologies
800K Floppy External 199.00
Monitors
Network Specialties
High Top FPD
Radius
Full Page Display 995.00
Two Page Display 1595.00
Sigma Designs
Laser View Display for II 1,749.00
Memory Upgrades
Dove Computer
Mac Snap 2SE
Scanners
AST
Turboscan1,349.00
Datacopy
730 Flatbed Scanner 1,199.00

#### MS/DOS SYSTEMS

Ast Premium 286 & 386 .	Call
IBM PS/2 25, 30, 50, 60,	80 Call
Leading Edge	899.00

#### **MS/DOS SYSTEMS**

NEC APC-IV Powermate . . . 2,399.00 PC-TOO 80286 1.2MB, 512K . . 899.00 



**TOSHIBA** T-1000 Laptop

\$799

#### **MULTIFUNCTION CARDS**

AST
6-Pak Plus 576 Board 149.00
Hot Shot 286 Accelerator 349.00
Hercules
Color Card
Graphics Card Plus 199.00
Intel
Inboard 386 Board 899.00
5th Generation
Logical Connection 256K 339.00
Quadram
Quad386XT 80386 PC-Upgr 899.00
Video 7
Vega V.G.A. Adapter299.00
Zuckerboard
Color Card w/Parallel Port 89.99

#### ME/DOS SOFTWARE

WIS/DUS SUFTWARE
Ashton-Tate
d-Base III +
Borland
Quattro169.00
5th Generation
Fastback Plus 89.99
Fox Software
Fox Base & Development219.00
IMSI
Optimouse w/dr. Halo 89.99
Logitec
Hi-Res Buss Mouse
Lotus
Lotus 1.2.3299.00
Software Publishing
First Choice
Word Perfect Corp.
Word Perfect 5.0249.00







**SELECT FROM OVER 3000 PRODUCTS** 

**COMPUTER MAIL ORDER** 

# When you want to talk price.

MONITORS
Amdek Video 210A 12'' Amber 89.00 Video 410 12''A/G/W (ea.) 139.00 Magnavox 7BM623 12'' TTL Amber 99.00 CM8505 14'' RGB/Composite .189.00
CM8515 14" RGB/Composite .269.00 9CM053 14" EGA379.00 9CM082 14" VGA Display459.00 <b>NEC</b> GS-1400 14" Monochr. TTL219.00
JC-1402 Multisync-II 599.00  Packard Bell  PB-1418F 14" Flat TTL A/G/W (ea.) 119.00  PB-1420CG 14" Mid-Res CGA 269.00
PB-1420CG 14" Mid-Res CGA 269.00 PB-1422EG 14" Hi-Res EGA369.00 PB-8426-MJ Uniscan Monitor .399.00 Princeton Graphics Max-12 12" TTL Amber 149.00
<b>Seiko</b> CM-1430 14''VGA Display 649.00



Magnavox CM 8762 14" RGB/Comp. \$269

\_\_\_

#### **DRIVES**

Atari
AA314 DS/DD ST Disk 219.00
SHD204 20MB ST Hard Drive . 619.00
C.LTD (For Amiga)
C.LTD 20MB (A2000) 769.00
C.LTD 33MB (A2000) 879.00
C.LTD 44MB (A2000) 1099.00
C.LTD 50MB (A2000) 1139.00
C.LTD A500 SCSI Controller 179.00
Indus
GT Disk Drive Atari XL/XE 199.00
GTS-100 ST Drive219.00
Racore
Jr. Expansion Chassis 299.00
Seagate Technologies
ST-225 20MB Drive 249.00
Supra
Atari ST 30 Meg Hard Drive 689.00
Amiga 2000 20MB Hard/Drive . 629.00

#### **MODEMS**

 Anchor

 6480 C64/128 1200 Baud
 .99.99

 520 ST520/1040 1200 Baud
 .129.00

 1200E 1200 Baud External
 .129.00

 Atari
 XMM301 XL/XE 300 Baud
 .44.99

 SX-212 St Modem
 .89.99

 Avatex
 .99.99

 1200 Hc External
 .99.99

 2400 External
 .179.00

 Best Products

2400 Baud ½ Card w/software 149.00 **Everex** 

Evercom 2400 Baud External .209.00



# Anchor Lightning 2400 F/I 2400 Baud Internal \$189

Hayes
Smartmodem 300 Ext 159.00
Smartmodem 1200 Int 279.00
Packard Bell
1200 External 89.99
2400 External 169.00
Practical Peripherals
1200 Baud Internal79.99
2400 Baud Stand Alone 189.00
Supra
2400AT 2400 Baud Atari 169.00
U.S. Robotics

#### **DISKETTES**

Direct 1200 Baud External . . . . 109.00

Direct 2400 Baud External . . . . 199.00

Maxwell
MD1-M SS/DD 51/4"8.49
MD2-DM DS/DD 51/4"9.49
MF1-DDM SS/DD 31/2"12.49
MF2-DDM DS/DD 31/2"18.49
MC-6000 DC-600 Tape 23.99
Sony
MD1D SS/DD 51/2"6.99
MD2D DS/DD 51/2''
MFD-1DD SS/DD 31/2" 11.99
MFD-2DD DS/DD 3½"16.99

#### **PRINTERS**

Atari
XDM-121 Letter Quality XL-XE 209.00
XM-M801 XL-XE Dot Matrix 199.00
XM-M804 ST Dot Matrix 199.00
Brother
M-1509 180cps 132col389.00
HR-20 22cps Daisywheel 379.00
Citizen
120D 120cps Dot Matrix 159.00
Premier-35 35cps Daisywheel .479.00
Epson
LX-800 150cps, 80 col179.00
FX-850 240cps, 80 col
FX-1050 264cps, 132 col Call
LQ-500 180 cps, 24-wire Call
LQ-850 330 cps, 80 col
LQ-1050 330 cps, 24-wire Call
FX-850, FX-1050New
Hewlett-Packard
2225A Thinkjet369.00
NEC
P2200 Pinwriter 24-wire 379.00
P660 Pinwriter 24-wire 459.00
P760 Pinwriter 132 col 679.00
Okidata
Okimate 20 color printer 129.00
ML-182 180 cps, 80 col 249.00
ML-320 300 cps, 80 col 379.00
ML-390 24 wire, 270 cps 519.00



#### Brother M-1109 100 cps, Dot Matrix \$1

Dot Matrix	°159
Panasonic	
KX-P1080i 144 cps, 80 c	ol 169.00
KX-P1091i 194 cps, 80 cc	ol 199.00
KX-P1092i 240 cps, 80 cc	
KX-P1595 200 cps, 132	col479.00
Star Micronics	
NX-1000 140 cps, 80 col	179.00
NX-1000C C64/128 Interfa	
NX-15 120 cps, 132 col .	329.00
Toshiba	
P321-SL 216 cps, 24-wire	499.00
P351-SX 300 cps, 24-wire	999.00

In the U.S.A. and in Canada

## Call toll-free: 1-800-233-8950

Outside the U.S.A. call 717-327-9575, Fax 717-327-1217 Educational, Governmental and Corporate Organizations call toll-free 1-800-221-4283 CMO, 101 Reighard Ave., Dept. A1, Williamsport, PA 17701 MICROCOMPUTER MICROCOMPUTER MARKETING COUNCIL of the Denet Marketing Association Inc.

OVER'350,000 SATISFIED CUSTOMERS • ALL MAJOR CREDIT CARDS ACCEPTED • CREDIT CARDS ARE NOT CHARGED UNTIL WE SHIP
POLICY: Add 3% (minimum \$7.00) shipping and handling. Larger shipments may require additional charges. Personal and company checks require 3 weeks
to clear. For faster delivery, use your credit card or send cashier's check or bank money order. Credit cards are not charged until we ship. Pennsylvania residents

to clear. For faster delivery, use your credit card or send cashier's check or bank money order. Credit cards are not charged until we ship. Pennsylvania residents add 6% sales tax. All prices are U.S.A. prices and are subject to change, and all items are subject to availability. Defective software will be replaced with the same item only. Hardware will be replaced or repaired at our discretion within the terms and limits of the manufacturer's warranty. We cannot guarantee compatibility. All sales are final and returned shipments are subject to a restocking fee. We are not responsible for typographic or photographic errors.

	d28c	0419	>move	dx,ss
Quaid Analyzer	cc8b	041b	move	cx,sp
Instruction Display	fa	041d	cli	
	c88c	041e	move	ax,cs
	d08e	0420	move	ss,ax
dx ax 0000 0000	0d60bc	0422	move	sp,0d60
ds:si bx 86c4:003e 085d	0200c481	0425	add	sp,0200
es:di cx 86c4:0000 0a9a	fb	0429	sti	137 (50)
ss:sp bp 86c4:0946 00a2	52	042a	push	dx
data 09c2:0008	51	042b	push	CX
code 09c2:0419	53	042c	push	bx
cs:ip 09c2:0419	51	042d	push	сх
oditsz.a.p.c	30b4	042e	move	ah,30
flags 0000001001000110	21cd	0430	int	DOScall
	•			

#### Part of a Quaid Analyzer display

Quaid Analyzer is a powerful diagnostic tool that shows what is going on inside your computer. The > at the top is the cursor. You can move it with the arrow keys. When you move the cursor off the screen, the instructions scroll like text in an editor. You can move the cursor into a register and change its value, or see the instructions or data it points to. Of course, you can scroll through the data display as well, and type new values into memory. With Quaid Analyzer you never have to type a command.

This example shows the first instructions executed when VDISK.SYS installs itself. You can see that it changes stack pointers, then gets the DOS version number. We got to this point by loading **Quaid Analyzer** before DOS, then watching the DOS call and disk interrupts until the driver was loaded, then putting a breakpoint on its first instruction. Drivers are installed before DOS gives you the first prompt. What other software tool can show you a device driver install?

Quaid Analyzer comes with a manual, and software on a 3 inch and a 5 inch diskette. If you are not satisfied with Quaid Analyzer, you can return it within 30 days for a refund. Quaid Analyzer is not sold by dealers in the United States or Canada. It is not copy-protected.

To order **Quaid Analyzer**, call us with your credit card, or send us a check for \$200 US funds. We ship within a day at our expense.



Quaid Software Limited
Third Floor Dept B633
45 Charles Street East
Toronto Ontario Canada M4Y 1S2

(416) 961-8243

Warning! For advanced programmers only.

step in the incremental construction of a solid model. Each operator changes the number of vertices (V), edges (E), and faces (F) in a way that maintains equality in Euler's formula: V - E + F = 2. This equality guarantees the topological validity of the model.

Solid modeling programs like the one described in this book are necessarily large and complex. Software engineers, even those not particularly interested in solid modeling, might enjoy reading this book just to learn more about how to write a large program. The author explains many of his decisions, including his selection of data structures and his design of a user interface.

Many listings of C code illustrate the book. While the syntax of C enables clever programmers to use tricks and shortcuts, Martti Mäntylä avoids those in favor of clear code. An experienced programmer who knows Pascal would have no trouble following the examples.

The exercises in the book offer readers a means of going beyond the text. Many are substantial projects. They constitute a guide for those who are interested in constructing their own solid modeling program, and a jumping-off point for those who are intent on developing their own program of research.

The bibliography lists 137 references, mainly to major journals. That in itself is a major attraction to the book for anyone seriously interested in the subject.

I enjoyed Martti Mäntylä's writing style and presentation. An Introduction to Solid Modeling is especially attractive because you can read it quickly or at your leisure, all at once or in bits and pieces. The author has constructed a very effective introduction to solid modeling, which at the same time challenges those who are experienced in the field.

-Leon Tabak

Programs and Data Structures in C by Leendert Am-

meraal, John Wiley & Sons, New York: 1987, 206 pages, \$24.95 (softcover). Leendert Ammeraal's book is a broad but not exhaustive introduction to data structures and algorithms using C.

After briefly defending C as an appropriate language for teaching and defending functioning programs as the best vehicle for teaching, Ammeraal plunges into a grab bag of tricks and techniques. The initial chapter on programming style discusses search sentinels, global variables, and recursion. Ammeraal's sometimes gruff text goes on to cover basics such as sorting, searching, and list manipulation; more advanced topics, such as doubly linked lists, Btrees, and interpreters/compilers; and esoteric topics like dynamic programming, tries, and graph representations. Example programs are workable for students but are not particularly general or extensible for professionals.

—Darrow Kirkpatrick

C as a Second Language by Tomasz Muldner and Peter W. Steele, Addison-Wesley, Reading, MA: 1988, 588 pages, \$27.95 (softcover). This is a comprehensive introduction to standard C, with some ANSI extensions included. Written primarily for those who were raised on Pascal, it provides clear discussions of the basics—data types, control structures, file I/O, functions, and strings—with very helpful and concise summaries of the most important points.

The book moves well beyond the basics with probing discussions of C features like pointers, bit fields, structured file I/O, enumerated types, and preprocessor instructions. Muldner and Steele include code to manage abstract data types such as graphs, lists, sets, and stacks. They also include a hearty calculator program featuring variables; a memory-management system with compaction; and a

continued

0

Computer

ň

Visit

Come

Store

Outlet

Club

Warehouse

Computer

oni

Come

Outlet

Club

Computer

oni

JOIN THE#1 "COMPUTER WAREHOUSE CLUB" ® FOR BUSINESS

- 35 Resident type fonts
- 4 standard interfaces 3MB of internal memory
- Includes Apple Talk Connector

LC 890 Toner Cartridge (6Pk.) ..



#### SOFTWARE **ALDUS** PAGEMAKER 3.0

Create your own brochures, newsletters, and reports withpage formatting, layout and design tools.

\$479<sup>75\*</sup>



#### SYSTEMS

THE®286/12

.512K of 1MB on the Motherboard • 6-12Mhz • Keyboard/Toggle Switch Selectable • 1.2MB Mitsubishi HDC/FDC • Phoenix Bios • 101 Key Keyboard • Monitor & Video Board Optional



Come

Visit

Our

Computer

Warehouse

Club

Outlet

Store

Come

Visit

Our

Computer

Warehouse

Club

Outlet

Store •

Come

Visit

입

Computer

<ul> <li>BUSINESS SOFTWAF</li> </ul>	lE -
ALDUS PageMaker 3.0	479.75*
ASHTON-TATE Dbase III+	345.32*
ASHTON-TATE Multimate Advan.II	235.35*
BORLAND INT Paradox 2.0	392.89*
BORLAND INT Quattro	129.00*
BORLAND INT Sidekick PlusBORLAND INT Sprint	112.11* 108.50*
BORLAND INT Turbo C or Basic	
CENTRAL POINT PC Tools Deluxe	
DAC SFT DAC Easy Accounting 3.0	
LOTUS DEVELOPMENT Lotus 1-2-3	279.00*
MERIDIAN TECH Carbon Copy Plus	100.49*
MICROSOFT "C" Compiler	271.69*
MICROSOFT Excel	285.32*
MICROSOFT Basic 4.0 or Windows	
MICROSOFT Word 4.0	199.00*
PEACHTREE SFT Accting Sys II PETER NORTON Utilities-Advanced	146.45*
QUARTERDECK OFFICE Desgview	68.25* 69.69*
SYMANTEC Q&A 3.0	186.85*
WORDPERFECT Wordperfect 5.0	205.00*
XEROX CORP Ventura Publisher	
com contract delicitor	

#### PLOTTERS/SCANNERS

<b>HOUSTON INSTRUMENTS</b> All Models	CALL
HEWLETT PACKARD Scanjet	984.75*
PRINCETON GRAPHICS LS-300	701.95*
IOLINE PLOTTERS	. CALL
SUMMAGRAPHICS(12 x 12)	342.39*
SUMMAGRAPHICS(12 x 18)	564.59*

#### PRINTERS

PANASONIC	
1080i 8.5", 144cps	170.69*
1592 15", 180cps	
KX-P4450 LASER 11PPM	1,469.00
CITIZEN	
180D 10", 180cps	166.65*
MSP-50 10", 300cps	388.85*
MSP-45 15", 240cps	437.00*
Tribute 224 15", 200cps, 24 Pin	
Premier 35 15", 25cps	
EPSON	

LX800 80 Col., 180cps ...... 176.00\*

LUSUU 80 COI., 180CDS	CALL
LQ1050 132 Col., 264cps	CALL
FX1050 132 Col., 264cps	CALL
FX850 80 Col., 264cps	CALL
NEC	
LC860 + 8PPM Laser	1,839.00*
<b>5200</b> 10", 265cps	503.49*
P9XL 15", 400cps	958.49*
P5300 15", 265cps	639.00*
P2200 Dot Matrix 10", 170cps	317.14*
OKIDATA	

#### OKIDATA **MICROLINE 383** PRINTER

Features 450cps in draft, mode, 180cps in nearletter-quality mode, 16' paper width, IBM compatible, top/bottom paper feed, parallel & serial ports

**390** 9.5", 270cps

439.00\*

443.12

MONO & COLOR CAR	DS
HERCULES Graphics Card Plus	170.69*
THE® Color Card or Mono	. 55.00*
<b>A.T.I.</b> EGA Wonder 800 x 560	162.00*
ORCHID Designer VGA (IBM PC/XT)	287.31*
PARADISE Auto Switch 480	162.00*
PARADISE VGA Plus Card	253.00*
VIDEO 7 Vega Deluxe 640 x 480	185.14*
VIDEO 7 VGA	249.96*

COMPUTER STSTEM	13
AST Premium 286 Model 80	1,542.77
AST Premium 286 Model 140	2,513.91*
COMPAQ Deskpro 286/40MB	2,295.25*
COMPAQ Deskpro 386/60MB	5,089.00*
COMPAQ Portable III MDL 40	3,850.00*
IBM PS/2 Model 30 CMS 20MB	1,473.59*
IBM PS/2 Model 50	2,499.75*
TOSHIBA T-1000 Laptop w/512K	719.00*
TOSHIBA T-3100/20 Laptop w/640K	2,838.00*
TOSHIBA T-5100 w/2MB RAM, 40MB	4,450.00*
TOSHIBA T-3200 Laptop	3,395.00
TOSHIBA T-1200 Laptop	2.125.00*

Call For Best Pricing On Other Models

# ScanJet Desktop Scanner

Flat-Bed Design Scaling/Resolution OCR/IBM Compatibility

Automatic Document Feeder

ScanJet Interface Card ...... \$348.45\*

#### FLOPPIES, DRIVES, TAPES

CMS 360K Ext. PS/2 Floppy	231.29*
10MEGA Bernoulli II 20MB Int	738.00*
IRWIN 64MB Int Tape for IBM PS/2	499.00*
IRWIN 145 40MB Internal Tape	419.65*
MINISCRIBE 3650 40MB Kit	360.57*
MITSUBISHI 360K 1/2 Ht Dr	. 79.79*
MITSUBISHI 1MB 3.5"FD	. 79.79*
MITSUBISHI 1.2MB Floppy 1/2 Ht	. 85.62*
PLUS DEVEL Hardcard 20	489.87*
PLUS DEVELHardcard 40	601.82*
SEAGATE ST-225 20MB Kit	249.00*
MINISCRIBE 3675 60MB HD Kit	389.00*
MINISCRIBE 6128 110MB RLL Full Ht	659.00*
SEAGATE ST-251 42MB/40MS HD	349.00*
SEAGATE ST-4096 80MB Full Ht	529.00*
SYSGEN Bridge File 3.5" Ext. Drive	205.00*

312-205-1300

SATURDAY 10:00AM-4:00PM

ay 9:00-4:00 CST

#### MITSUBISHI **DIAMOND SCAN** 13" Color Monitor

\$455<sup>00\*</sup>

NEC Multisync II Hi-Res 13"

\$544<sup>39</sup> Monitor ..... Call For Best Prices on Magnavox, Amdek, IBM, Princeton, and THI-®

#### MODEMS

<b>HAYES</b> Smartmodem	2400	392.89*
<b>HAYES</b> Smartmodem	1200	261.59*
U.S. ROBOTICS HST	9600	604.99*

#### **MULTIFUNCTION CARDS**

AST Advantage Premium	295.00*
INTEL Above Board 286	385.00*
ORCHID Tiny Turbo 286	241.39*
ORCHID Twinturbo 12	342.39*
THE®Multi I/O w/P/S/G/CLK/CAL	

#### MATH CO-PROCESSOR

INTEL 80287 10MHZ Co-Processor	284.50*
INTEL 8087-2 Math Co-Processor	147.00*
INTEL 80387-16 Co-Processor	445.00*

#### **MICE & ACCESSORIES**

LOGITECH Logimouse +	69.69*
LOGITECH Hi-Res Mouse	85.85*
MICROSOFT Mouse w/Paintbrush	93.50*
MICROSOFT Mouse w/Windows	
CENTRAL PT Deluxe Option Brd	106.05*
CURTIS Ruby + w/Fax Protector	63.63*
KENSINGTON Masterpiece+	99.99*
THE COMPLETE PC Complete Fax	297.95*
<b>FUJI</b> 3 1/2" DS/HD Box of 10	45.45*
UNISON Unipower 400 UPS	329.00*
640K & 256K CHIPS	CALL
DISKETTES (25) Hi Dens IBM AT	32.82*
<b>DISKETTES</b> (50) 5 1/4" DS/DD	17.50*
The state of the s	

#### FAX MACHINES SHARP 00\*

### **Z-50**

Features accurate auto exposure, lightweight and compact for home or office use, 4-color single tone copying, 2-way paper feed plus more.

**SHARP** Toner Cartridge

60.60\*

\$1,13120 SHARP Fax FO-300 ..... SHARP FO20 Fax Paper (6rolls) .... 23.23\*

REAL BUYING CLOUT- Call now and join over 200,000 members who are too smart to pay more! MEMBERSHIP BENEFITS: \* Pay just 8% above advertised wholesale price · 3%cash discount (included in wholesale price) · Price Protection • Optional software rental library • FREE Wholesale Buyers Guide • FREE UPDATES • Fully Insured 48 Hour Delivery • 10 day Return Policy • FREE Technical Support • FREE Bulletin Board • Quantity Discounts • All Prices Subject To Change. All Products Subject To Availability. JOIN TODAY FOR AS LITTLE

All Prices Shown are Wholesale Prices

Call for FREE Catalog • Call f



All the software, alignment diskettes, parallel/serial wrap-around plugs, ROM POSTs and extensive, professional documentation to provide the most comprehensive testing available for IBM PCs, XTs,ATs and *all compatibles* under DOS or Stand Alone. No other diagnostics offers such in-depth testing on as many different types of equipment by isolating problems to the board and chip level.

**NEW:** SuperSoft's **ROM POST** performs the most advanced **Power-on-Self-Test** available for system boards that are compatible with the IBM ROM BIOS. It works even in circumstances when the Service Diagnostics diskette cannot be loaded.

NEW: 386 diagnostics for hybrids and PS/2s!

For over nine years, major manufacturers have been relying on SuperSoft's diagnostics software to help them and their customers repair microcomputers. End users have been relying on SuperSoft's Diagnostics II for the most thorough hardware error isolation available. Now versions of Service Diagnostics are available to save everyone (including every serious repair technician) time, money, and headaches in fixing their computers, even non-IBM equipment.

All CPUs & Numeric Co-processors System Expansion & Extended Memory Floppy, Fixed & Non-standard Disk Drives Standard & Non-standard Printers System Board: DMA, Timers, Interrupt, Real-time Clock & CMOS config. RAM

All Color Graphics & Monochrome Monitors Parallel & Serial Ports Mono, CGA, Hercules & EGA Adapters All Keyboards & the 8042 Controller

Join the ranks of XEROX, NCR, CDC, SONY, PRIME, ... who have bundled SuperSoft's diagnostics with their microcomputers at no risk because of our 30 day money back guarantee.

Service Diagnostics for PC, PC/XT, and compatibles only	\$16
Alignment Diskette for PC, PC/XT and compatibles (48 tpi drives)	\$ 5
Wrap-around Plug for PC, PC/XT and compatibles (parallel and serial)	\$ 3
Service Diagnostics for AT and compatibles only	\$16
Alignment Diskette for AT and compatibles (96 tpi drives)	\$ 5
Nrap-around Plug for AT (serial)	\$ 1
ROM POST for PC, PC/XT, and compatibles only	\$24
ROM POST for AT and compatibles only	\$24
Service Diagnostics: The KIT (includes all of the above—save \$502)	\$49
Service Diagnostics for all other CPUs (386, V20, V30, Harris, etc.)	\$19
Diagnostics II is the solution to the service problems of users of all CP/M-80,	
CP/M-86 and MS-DOS computers	\$12
ROM POST for PS/2 and compatibles only	\$24
Alignment Diskette for PS/2 and compatibles (3.5 inch)	

To order, call 800-678-3600 or 217-359-2112, FAX 217-359-7225, or write SuperSoft.



FIRST IN SOFTWARE TECHNOLOGY P.O.Box 1628 Champaign, IL 61820 (217) 359-2112 Telex 270365

SUPERSOFT is a registered trademark of SuperSoft, Inc.; CDC of Control Data Corp.; IBM PC, AT & XT of International Business Machines Corp.; MS-DOS of MicroSoft Corp.; NEC of NEC Information Systems, Inc., PRIME of PSIME INC.; Sony of Sony Corp.

database using an external binary search tree.

—Darrow Kirkpatrick

Perceptrons by Marvin L. Minsky and Seymour A. Papert, MIT Press, Cambridge, MA: 1988, 292 pages, \$12.50. Perceptrons has been the classic textbook on connectionist learning machines since its publication in 1969, and the recent surge of interest in artificial neural systems makes the printing of an expanded edition welcome.

Initially, owners of the previous edition of this work may be disappointed by the new book. It turns out to be a reprint of the old edition sandwiched between about 45 pages of a newly written prologue and epilogue.

The short prologue, entitled "A View from 1988," is an overview of the history of artificial neural systems and the authors' commentary on why the state of the art has progressed little since the book was first published.

The epilogue, which accounts for the lion's share of the new text, is an interesting essay entitled "The New Connectionism," which includes discussion of the significant Rummelhart and McClelland work on parallel distributed processing. Minsky and Papert do a good job of tying the theory and application of perceptrons to other paradigms coming into vogue in the science of neural networks.

While billing the new *Perceptrons* as an "expanded edition" may be overdoing things, the authors' additions are important enough to justify putting the book on the shelf next to the older edition. With or without the additions, of course, *Perceptrons* will always remain a classic in its field.—*Eric Bobinsky* 

BASIC Mathematical Programs for Engineers and Scientists by H. Guggenheimer, Petrocelli Books, Princeton, NJ: 1987, 233 pages, \$19.95. This new addition to the large body of litera-

ture on numerical computing offers welcome relief from both the code-starved mathematical textbooks on numerical analysis and the simpleminded cookbooks that provide code but little or no useful explanations.

The author, a university mathematics professor, has put together 40 BASIC programs covering such diverse topics as vector geometry, roots of equations, integration and differentiation, ordinary differential equations, linear algebra, Fourier analysis, and gamma and Bessel functions. As important as the code itself, each program is accompanied by a readable and thorough treatment of the theory behind the algorithm.

The book's conversational style and expert presentation make it enjoyable to read, and, although the author states that the text is for "anyone who is not a computer scientist or mathematician," many practicing professionals will nonetheless find it useful.

The only negative aspect of the book is its use of Microsoft GWBASIC. Much more elegant and understandable programs would have followed from the use of any of the new, structured BASIC dialects. Fortunately, Pascal-like pseudocode versions of each routine are presented, and they make the book valuable even to those who write code in something other than BASIC.

At \$19.95, this excellent little paperback is a bargain.

—Eric Bobinsky ■

#### CONTRIBUTORS

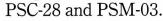
Critic and author Hugh Kenner lives in Baltimore, MD. Leon Tabak is a visiting lecturer in computer science at Worcester (MA) Polytechnic Institute. Darrow Kirkpatrick is a freelance writer and computer consultant living in New Paltz, New York. Eric Bobinsky is a mathematician at NASA's Lewis Research Center in Cleveland, Ohio.



# Princeton's Very Good Answers.

Without question, Princeton's PSC-28 and PSM-03 monitors will bring you the ultimate in VGA performance. Princeton was the first to offer truly compatible VGA dedicated monitors. Our PSC-28 is a 770 × 570, .28mm dot pitch, high resolution analog color monitor that can display an infinite number of colors. The PSC-28 also features a convenient color button for green, amber or cyan text. The PSM-03, a high resolution analog monochrome monitor gives you outstanding 800 × 630 resolution, and the ability to display infinite shades of gray. Plus sharp crisp graphics and character definition from its dynamic focusing circuitry.

Both monitors are compatible with IBM PC\*, XT\*, AT\*, PS/2, Apple Macintosh SE\* and compatible personal computers. Each gives you full compatibility with the leading VGA adapter cards including the QuadVGA and VEGA VGA. So if VGA meets all your needs (and you don't require the additional flexibility of our famous ULTRASYNC and MAX-15 autosynchronous monitors), investigate the cost/performance value of the



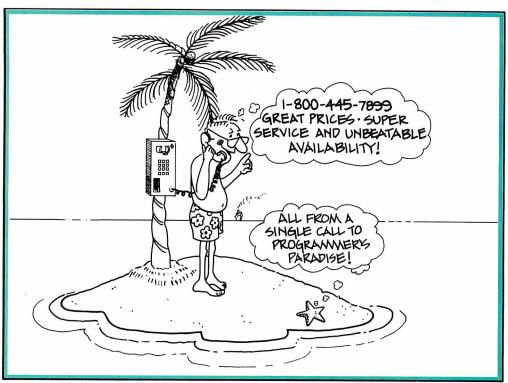
Unsurpassed quality, service and performance make it hard to beat Princeton monitors. We offer better value than our competition. We call it the Visible Edge. For answers to all your questions about VGA compatible monitors, contact us at 601 Ewing Street, Building A, Princeton, New Jersey 08540 (609) 683-1660, x 810.

\*Requires proper adapter card





# PRICES YOU CAN FIND ONLY I



CALL PROGRAMMERS PARADISE TODAY and discover our commitment to bringing you the best software at the best prices. You'll also find software pros to help you select the product that you need plus immediate shipment on our stock of 1000 products and a 30-day money back guarantee. Paradise is ready and waiting for you.

Periscope I

Integrated Development Lib.

386 SOFTWARE 386-to-the-Max DESQview FOXBASE +/386 High C-386 Microport System V/386 (complete) Runtime System MS Windows/386 NDP C or Fortran-386 PC-MOS 386 PharLap 386/ASM/Link	66 115 CALL 799 769 255 130 529 CALL 409	Greenleaf Bus. Math Lib. Greenleaf Comm Library Greenleaf Functions Greenleaf Super Function Greenleaf Turbo Function PforCe PC-Lint Pre-C Resident C w/Source TimeSlicer w/Source Turbo C Tools
SCO Xenix System V 386 (complete) Operating System VM/386	1279 589 182	COBOL Microsoft COBOL Opt-Tech Sort Realia COBOL
ASSEMBLERS/LINKERS Advantage Disassembler MS Macro Assembler OPTASM Plink86plus	279 99 109 279	RM/COBOL-85 SCREENIO  DATABASE COMPILITOOLS
Visible Computer 80286  BASIC Finally! Flash-Up	90 90 80	Clear
MS Basic Comp. 6.0 MS QuickBASIC QuickPak Professional QuickWindows w/Source	199 69 105 90	RETURNS AI BREEZE
Screen Sculptor Turbo Basic Turbo Basic Toolboxes  C COMPILERS/INTERPRI	96 69 69	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
	220	area.
C-Terp Lattice C	289	Clipper
Microsoft C	299	dBFast
Quick C	69	FoxBASE+
Run/C Professional	159	Hi-Screen XL
Turbo C	69	Integrated Development Quicksilver
C LIBRARIES/UTILITIES C Async Manager	137	R & R Say What!
C Tools Plus/5.0	101	Silvercomm Library
	125	
C Utility Library CxPERT	CALL	DEBUGGERS
CXPERI	TALL	DEDUCIONS

Greenleaf Comm Library Greenleaf Functions Greenleaf Super Functions Greenleaf Turbo Functions PforCe	159 169 155 179 109 215	Periscope II Periscope II-X Periscope III 10 MHZ Pfix 86 Plus T-Debug Plus V. 4.0 w/Source	141 106 1143 215 39 80
	101 159	DISK/DOS/KEYBOARD	
Resident C w/Source	169	UTILITIES	
	279	Advanced Norton Utilities	99
	899 101	Command Plus V. 2.0	70
10100 € 10013	101	Disk Optimizer Fastback Plus	56 142
COBOL		Mace Utilities	90
	599	Norton Commander	56
	105	Norton Utilities	61
	794 999	PC Tools Deluxe	70
	382	Vfeature Deluxe X-Tree Pro	111 111
DATABASE COMPILERS/		71 West 1 Ve	
TOOLS		EDITORS	
Clear	90	Brief	CALL
	50	w/dbrief	CALL
		EDIX	169
		Epsilon KEDIT	151 120
	1	MKS Vi	66
RETURNS ARE A	1	Multi-Edit	90
	)	Norton Editor	70
BREEZE		PC/EDT +	269
		PI Editor	165
		SPF/PC Vedit Plus	185 131
		vedit i idə	131

Triditi Edit	70
Norton Editor	70
PC/EDT +	269
	165
	185
veait Plus	131
FILE MANAGEMENT	
Btrieve	185
Xtrieve	189
Report Option	109
	455
	141
	318
r-tree	241
d-tree	CALL
dBC III	169
dBC III Plus	599
	CALL
Informity ESOLIC ACL SOL	CALL
AQL	599
	Norton Editor PC/EDT + PI Editor SPF/PC Vedit Plus

Lahey F77 FORTRAN	429
Lahey Personal FORTRAN 77	86
MS FORTRAN	299
RM/FORTRAN	479
GRAPHICS Advantage Graphics (C) Essential Graphics w/Source GraphiC GSS Graphic Dev. Toolkit HALO '88 HALO '88 (5 Microsoft Lang.) MetaWINDOW MetaWINDOW Plus	229 229 509 322 409 229 399 162 232

**FORTRAN COMPILERS** 



#### **OBIECT-ORIENTED PROGRAMMING**

Actor	439
Advantage C++	479
C-Talk	129
PforCe + +	215
Smalltalk/V	85
Communication Applic. Pack	45
EGA/VGA Color Ext. Pack	45
Goodies #1, 2 or 3 Applic. Packs	45
Smalltalk/V286	169

#### OPERATING SYSTEMS

OI LIVALING SISILING	
Microport:	
286 DOS Merge	219
System V/AT	549
Runtime Package	209
Software Dev. Package	255
Text Preparation Package	169
Unlimited License Kit	209
SCO:	
Xenix System V (complete)	979
Development System	479
Development System Operating System Text Processing Package	479
Text Processing Package	149
Xenix for PS/2 50, 60, 80	CALL
Wendin DOS 2.15 NEW	109

#### TROPICAL TREATS

dBx Translator

dBx Translator
New dBx version 4.0 compiles dBASE III Plus programs into portable C source code with full runtime terminal and file support. Execute C fast on PC, or run on UNIX or VAX.
\$469

PI Editor
Blazingly fast editor with
multi files, full on-line contextual help, compile integration, undo, macro language
with integrated source debugger, E/EMS and VGA/EGA
support.
\$165

Periscope I Now includes a 512K write protected 16 bit RAM board, along with breakout switch. Store symbol tables, defini-tion files, etc. in addition to the Periscope debugger soft-ware, outside DOS memory. \$563

Essential Comm Library

# PARADISE 1-800-445-7899

PASCAL COMPILERS Microsoft Pascal	199
Professional Pascal Turbo Pascal	549 69 289
Turbo Pascal Dev. Toolkit TURBO PASCAL ADD-ON	
Flash-Up	80
Flash-Up Toolbox	46
Mach 2	66
Screen Sculptor	96
T-Debug Plus V. 4.0	39
w/Source	80
Turbo Analyst 4.0	69
Turbo Async Plus	101
Turbo Halo	80
Turbo Halo Turbo Magic Turbo Power Tools Plus	179 101
Turbo Power Utilities	79
Turbo Professional 4.0	80
Turbo WINDOW/Pascal SCREENS/WINDOWS	80
C-Scape	282
Greenleaf DataWindows	219
Makeform NEW Panel Plus	99 395
Panel/QC or /TC	99
POWER SCREEN NEW	101
Vitamin C	149
VC Screen	119
Windows for C Windows for Data	149 259 519
w/Source ADDITIONAL PRODUCT	
Carbon Copy Plus	142
Dan Bricklin's Demo Prog. II	179
FLOW CHARTING II	205
Logitech MOD II Dev Sys	209
MathCAD	282
MKS Toolkit	145
PC Scheme	86
Pfinish	215
PolyMake	131
PVCS Corporate	359
Source Print	80
Tree Diagrammer	70
BORLAND Eureka	119
Paradox 1.1	369
Paradox 2.0	529
Quattro	169
Sidekick Plus	125
Turbo Basic Compiler	69
Database Toolbox	69
Editor Toolbox	69
Telecom Toolbox	69
Turbo C Compiler	69
Turbo Pascal	69
Turbo Pascal Dev. Toolkit	289
Turbo Tutor	45
Numerical Methods TB	69
Database Toolbox	69
Editor Toolbox	69
Gameworks Toolbox	69
Graphix Toolbox	69
Turbo Prolog Compiler	105
Turbo Prolog Toolbox MICROSOFT	69
MS Basic Compiler 6.0	199
MS Basic Compiler (XENIX)	449
MS Basic Interpreter (XENIX) MS C Compiler	229 299
MS COBOL Compiler for XENIX	599 649
MS Excel	329 299
for XENIX MS Learning DOS	449 39 99
MS Macro Assembler MS Mouse Serial or Bus w/Easy Cad	99 119
w/MS Windows	139
MS OS/2 Programmer's Toolkit	239
MS Pascal Comp. for XENIX MS QuickBASIC	199 449
MS QuickC	69 69
MS Sort MS Windows MS Windows Development Kit	130 69

#### PROGRAMMER'S PARADISE:

**Microsoft** \*QUICK C Microsoft QuickC is a powerful first step into C programming. It compiles at the blazing speed of 10,000 lines per minute. It has a full-featured debugger. And its seamlessly integrated environment means you don't have to switch between tools. So go to C. New QuickC from Microsoft SPECIAL! QuickC and Microsoft Serial Mouse Bundle **LIMITED TIME OFFER: \$149** 



Software

#### WINDOWS FOR DATA

Build a state-of-the-art user interface into your application. Complete, professional C-library for building and managing menus, data-entry forms, user help and text files in a windowing environment. Allows flexibility to create screens "your own way

Features include: Field entry from lists of choices, scrollable regions for entry of a variable number of line items, nesting and branching of forms and menus. Unique, Vermont built-in debugging system. Creative

Ours: \$259

WENDIN-DOS VERSION 2.5
WENDIN-DOS is the new multi-tasking, multi-user MS-DOS replacement operating system for IBM compatible Personal Computers. Version 2.5 allows users to create hard disk partitions greater than 32 MB. WENDIN-DOS uses the MS-DOS file system, and supports MS-DOS commands while providing new ones to enable multi-tasking, file protection, and command language extensions and enables you to access your files with DOS, UNIX, or VAX/VMS style file names — whichever you prefer. WENDIN-DOS supports several users on the same computer. WENDIN-DOS now includes XTC, Wendin's ULTIMATE PROGRAMMER'S EDITOR! Minimum 512K memory. 

Ours: \$109

GREENLEAF **SUPERFUNCTIONS** LIBRARY



The new Greenleaf SuperFunctions
Library contains over 350 features
including expanded memory access
using the LIM 4.0 interface, high level DOS function access like the critical error handler, advanced time and date functions, many menu and window creation options, automatic screen re-fresh for overlaid windows and device independence plus demo programs and free source. For IBM and compatibles with MS DOS/PC DOS 2.0 + . Ours: \$179

### HOW WE WORK

PHONE ORDERS Hours 9 AM-7 PM EST. We accept MasterCard, Visa, American Express. Include \$3.95 per item for shipping and handling. All shipments by UPS ground. Rush service available, ask for rates when you order.

#### MAIL ORDERS

POs by mail or fax are welcome. Please include phone number.

#### RETURN POLICY

Our "No Hassle" policy means if you're not satisfied with a product from Programmer's, simply return it within 30 days for a refund. Some manufacturer's products cannot be returned once disk seals are broken, so check before you buy.



## INTERNATIONAL

Take advantage of our International business number for details on export charges and exchange rates. Payments should be made in U.S. dollars.

#### DEALERS AND CORPORATE ACCOUNTS Call and ask for our catalog and special volume discounts.

#### BEATABLE PRICES

We'll match lower nationally advertised prices.

In NY: 914-332-4548 **Customer Service:** 914-332-0869 International Orders: 914-332-4548

Telex: 510-601-7602 Fax: 914-332-4021

Call or Write for Latest Free Catalog!

1-800-445-7899

Programmer's

A Division of Magellan Software Corp 55 South Broadway, Tarrytown, NY 10591



319

130

285

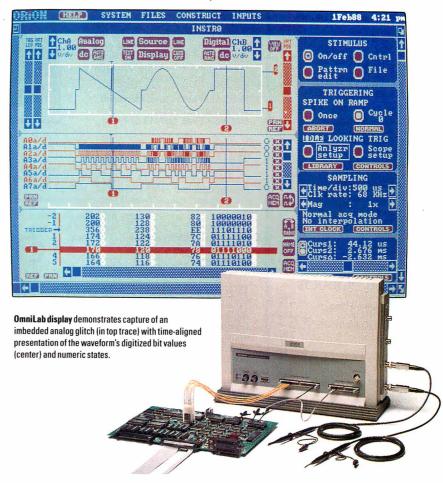
MS Windows Development Kit

MS Windows/386

MS Word

# Introducing OmniLab 9240. Totally Integrated Scope-Analyzer-Stimulus.

- Combine a 100 MHz digital oscilloscope with a time-aligned, 200 MS/s 48-channel logic analyzer. Next add synchronized analog and digital stimulus generators. Then a remarkable new triggering system. What you have is the 9240 a whole new class of instrumentation. Expressly designed to speed challenging analog and digital analysis. And get you from concept to product faster.
- The 9240 is based on an innovative new instrument architecture that merges high-speed universal hardware and seamlessly-integrated software to create high-performance capabilities not available in separate instruments. Analog and digital traces are always time-correlated in a unique, single screen display. SELECT™ triggering bridges scope and analyzer techniques. And OmniLab's stimulus generators can playback captured or edited signals.
- Triggering, the most straightforward and complete solution **ever** to triggering dilemmas. It's one system, operating with synchronized analog and digital views of your data. By combining conventional oscilloscope and analyzer triggering with powerful RAM truth tables plus min/max time qualification as needed SELECT triggering helps you analyze hardware, debug software, and integrate systems more easily.
- OmniLab™ is a generation ahead of conventional digital scopes that often hide rarely occurring faults because they only show you a few cycles out of millions. With its continuous monitoring, you can use SELECT triggering to quickly catch every occurrence



of rare events like metastable states, bus contentions, missing pulses, and buried noise glitches.

- The 9240 is like having a complete benchtop of instruments integrated with your PC/AT or compatible. Which you can easily customize for digital development, analog development, or a combination of both.
- With OmniLab, your productivity will soar. Because you achieve results with fewer instruments. And in fewer steps than ever before. By no means least, the 9240 delivers the best price/performance you'll find anywhere, costing just \$8900 fully outfitted. And most importantly, without compromising a single high-performance spec. Not a one.
- **NO-COMPROMISE 9240 SPECIFICATIONS DIGITAL OSCILLOSCOPE LOGIC ANALYZER** Digitizers: Two. 8 bit Inputs: 48, timing and state Bandwidth: 100 MHz Asynchronous Clocking: 34 MS/s on 48 inputs; Single-Shot Digitizing: 34 S/s to 204 MS/s 204 MS/s on 8 inputs Repetitive Sampling: 680 MS/s Repetitive Sampling: 680 MS/s on 48 inputs Scale Factor: 5 mV/div to 10V/div 0 to 34 MS/s Synchronous Clocking: 4K samples (16K, 64K optional) in 1-2-5 sequence **Acquisition Memory:** Record Length: 4K (16K, 64K optional) **Disassembly Options** Over 150 microprocessors **ANALOG STIMULUS DIGITAL STIMULUS** 8mV to 8 V peak-to-peak, 8 bit 24, 74F tri-state drivers Output: Outputs: Cycle Length: 4 to 4K samples (16K optional) Cycle Length: 4 to 4K samples (16K optional) Clocking 34 S/s to 34 MS/s Timing 34S/s to 34MS/s **Functions** Record, edit and playback **Functions** Record, edit and playback
- For more information, call **toll free 800/245-8500.** In CA: 415/361-8883. Or write for complete literature.



702 Marshall Street, Redwood City, CA 94063 TELEX: 530942 FAX: 415/361-8970

#### **Computer Integrated Instrumentation**

\*OmniLab, and SELECT are trademarks of Orion Instruments. Inc.

# PRODUCTS IN PERSPECTIVE

#### 67 What's New

89 Short Takes
Toshiba 3-in-One P321SLC
Illustrator 88
AppleCD SC
Super PC-Kwik and PolyBoost II
Tickler/2
Zortech Comm Toolkit

#### **Expert Advice:**

- 101 Computing at Chaos Manor by Jerry Pournelle
- 119 Applications Plus by Ezra Shapiro
- 129 Down to Business by Wayne Rash Jr.
- 133 Macinations by Don Crabb
- 139 OS/2 Notebook by Mark Minasi

#### 144C COM1: by Brock N. Meeks

#### **First Impressions**

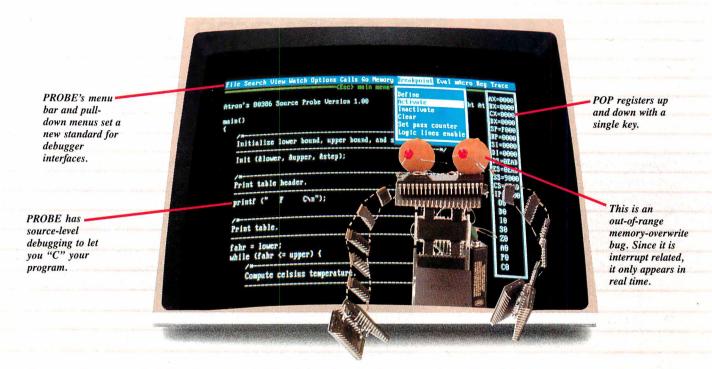
- 151 Borland Beefs Up Its Languages
- 157 Presentation Manager and LAN Manager

#### Reviews

- **164** 80386s for the Masses
- 179 Dell's System 310
- 185 The Amstrad PPC640 and the Epson Equity LT
- 194 Five low-end scanners for the Mac
- 201 C\_Talk
- 209 Turbo Prolog 2.0
- 215 D the Data Language
- 223 Sprint



# IT'S TIME TO DO SOME SERIOUS 386 BUGBUSTING!



relcome to your nightmare. Your company has bet the farm on your product. Your demonstration wowed the operating committee, and beta shipments were out on time. Then wham!

All your beta customers seemed to call on the same day. "Your software is doing some really bizarre things," they say. Your credibility is at stake. Your profits are at stake. Your sanity is at stake.

#### THIS BUG'S FOR YOU

You rack your brain, trying to figure something out. Is it a random memory overwrite? Or worse, an overwrite to a stack-based local variable? Is it sequence dependent? Or worse, randomly caused by interrupts? Overwritten code? Undocumented "features" in the software you're linking to? And to top it off, your program is too big. The software debugger, your program and it's symbol table can't fit into memory at the same time. Opening a bicycle shop suddenly isn't such a bad idea.

#### THIS DEBUGGER'S FOR YOU

Announcing the 386 PROBE™ Bugbuster,\*from Atron. Nine of the top-ten software developers sleep better at night because of Atron hardware-assisted debuggers. Because they can set real-time breakpoints which instantly detect memory reads and writes.

Now, with the 386 PROBE, you have the capability to set a *qualified breakpoint*, so the breakpoint triggers only if the events are coming from the wrong procedures. So you don't have to be halted by breakpoints from legitimate areas. You can even detect obscure, sequence-dependent problems by stopping a breakpoint only after a specific chain of events has occurred in a specific order.

Then, so you can look at the cause of the problem, the 386 PROBE automatically stores the last 2K cycles of program execution. Although other debuggers may *try* to do the same thing, Atron is the only company in the world to dequeue the pipelined trace data so you can easily understand it.

Finally, 386 PROBE's megabyte of hidden, write-protected memory stores your symbol table and debugger. So your bug can't roach the debugger. And so you have room enough to debug a really big program.



COULD A GOOD NIGHT'S SLEEP PUT YOU IN THE TOP TEN?

Look at it this way. Nine of the top-ten software products in any given category were created by Atron customers. Maybe their edge is - a good night's sleep.

Call and get your free, 56-page bugbusting bible today. And if you're in the middle of a nightmare right now,

of a nightmare right now, give us a purchase order number. We'll FEDEX you a sweet dream.



A division of Northwest Instrument Systems, Inc. Saratoga Office Center • 12950 Saratoga Avenue Saratoga, CA 95070 • Call 408/253-5933 today.

## What's New

SYSTEMS

#### Switchable CPUs and a Dual Bus, Too

ells American's CompuStar is actually a "convertible" computer that can switch between an IBM PC AT bus and a Micro Channel bus. In addition, you can set it up to use any of four central processing modules: 8086, 80286, 80386, or 80386SX (which is scheduled to ship in mid-October). The snap-in processor modules, which plug into the motherboard, are interchangeable, the company claims.

All CompuStar models, regardless of the CPU or bus configuration, are equipped with a parallel port, a mouse port, a keyboard and keyboard port, two serial ports, an EGA port, a VGA port, a disk controller, and a 220-watt power supply. The BIOS is by Wells American.

For file-server applications (which increase the possibility of overheated components), each version has two fans—one for pressurizing the hard, floppy, and optical disk drives, and one for creating a vacuum within the printed circuit board areas.

Wells will sell the Compu-Star much like a pick-the-component system. Besides an operating system (MS-DOS, OS/2, or Unix), you can choose from a selection of video interfaces, drives (including, later, a Maxtor erasable optical drive), keyboards, and so on. Price: Basic 8086 machine, \$995; 80286 machine, about \$20,000; full-featured 80386 machine, up to \$25,000. Contact: Wells American Corp., 3243 Sunset Blvd., West Columbia, SC 29169. (803) 796-7800. Inquiry 781.



CompuStar includes everything but the kitchen sink.

#### **Apollo Launches** First 68030-based System

n its base configuration, Apollo Computer's Series 3500 is a Motorola 68030based diskless microcomputer that will run at 4 million instructions per second (MIPS).

The 68030 processor makes the 3500 compatible with previous 68000-series machines, resulting in faster

workstations. Clock speed on the 3500 is 25 MHz with no wait states. The standard 4 megabytes of RAM can be expanded to 32. There are 7 16-bit AT slots and three serial ports, and the BIOS is by Phoenix Technologies.

The operating system is Apollo's Domain/OS version of Unix. But "off-the-shelf" MS-DOS applications are supported either by an optional 80286 coprocessor or with a software emulator. The coprocessor, an add-in card, can be purchased and installed on

a file server and used by all. Price: \$7990; 80286 coprocessor add-in, \$1990; MS-DOS software emulator, \$500; 19-inch monochrome monitor, \$1000; 15-inch color monitor, \$2000; 155megabyte ESDI hard disk drive and controller, \$4500; 348-megabyte drive, \$7500. Contact: Apollo Computer, Inc., 330 Billerica Rd., Chelmsford, MA 01824, (617) 256-6600. Inquiry 782.

#### The Desktop and Portable 80386SXes

ntel's new low-cost 80386SX chips have made an appearance in NEC's newest machines-the Power-Mate SX and the PowerMate Portable SX. Both machines feature 16-MHz clock speeds and 2 megabytes of RAM, expandable to 16 megabytes.

Additional features of the standard SX machine include a 1.2- or 1.44-megabyte floppy disk drive and a 42-megabyte hard disk drive. The BIOS is by Phoenix Technologies. One RS-232C serial port, one parallel port, and one 8-bit and five 16-bit expansion slots are standard. There's room for two 51/4-inch and one 31/2inch (optional) disk drives. ESDI hard disk controllers are also available.

The Portable SX comes standard with a 360K-byte or 1.2-megabyte floppy disk drive and a 42-megabyte hard disk drive.

Price: \$4495 for the Power-Mate SX; \$6595 for the Power-Mate Portable SX. **Contact: NEC Information** Systems, Inc., 1414 Massachusetts Ave., Boxborough, MA

Inquiry 783.

01719, (508) 264-8000.

continued

#### and more cost-effective SEND US YOUR NEW PRODUCT RELEASE

We'd like to consider your product for publication. Send us full information, including its price, ship date, and an address and telephone number where readers can get further information. Send to New Products Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Information contained in these items is based on manufacturers' written statements and/or telephone interviews with BYTE reporters. BYTE has not formally reviewed each product mentioned. These items, along with additional new product announcements, are posted regularly on BIX in the microbytes.sw and microbytes.hw conferences.

#### PERIPHERALS

#### Macro Font Cartridges Do It All

f you need multiple fonts for your HP LaserJet II or Cannon printers and don't want to buy and swap dozens of cartridges, Pacific Data has the solution in five multifont cartridges.

The new "25 Cartridges in One" font cartridge includes all 25 fonts that are available on HP LaserJet cartridges, including the S1, S2, and Z1A, Pacific Data reports.

Four other cartridges offer similar multiple-cartridges-inone performance for HP and Canon laser printers. The SixPack cartridge combines all seven of HP's compatible monospaced fonts and symbol sets and is designed for applications where column alignment is important.

Up to 240 characters per line in both portrait and landscape mode (the Lotus maximum) can be printed with the Spreadsheet cartridge. It includes five different point sizes, including a size for titles and headings. The Z cartridge, containing typographic masters to match the look of PostScript, is designed for such word processing programs as Microsoft Word for typeset-quality documents with proportional spacing.

Also for word processing and desktop publishing, the F cartridge includes a fixedpitch line-printer font for monospaced word processing applications. And it's compatible with PageMaker and Ventura Publisher. Price: 25 Cartridges in One, \$399; Six-Pack, \$99; Spreadsheet, \$199; Z cartridge, \$99; F cartridge, \$99. Contact: Pacific Data Products, 6404 Nancy Ridge Dr., San Diego, CA 92121, (619) 552-0880. Inquiry 793.



25 Cartridges in One packs five fonts into each cartridge.

#### Support a Third Floppy with Your AT Controller

anzana MicroSystems has equipment to add a third floppy disk drive (3½-inch) to your AT without having to add another controller. Your existing controller can now power both 5¼-inch disk drives and a 3½-inch in-

ternal disk drive.

Standard equipment includes a multiplexer adapter card to split the controller signal, 3Five Software, and a 3½-inch floppy disk drive in a 5¼-inch frame, plus internal cabling. The software allows XTs, ATs, and compatibles to support the 3½-inch disk drive and includes a device driver and a format program that offers either 720K bytes or 1.44 megabytes of storage

(depending on which type of drive you've installed). It is compatible with all desktop systems using DOS (including PS/2s and HP 150 systems) and most laptops such as Toshiba, IBM, Zenith, Tandy, and GRiD.

Price: With 720K bytes of storage, \$299; with 1.44 megabytes of storage (works with 720K, 360K, or 180K bytes as well), \$340.

Contact: Manzana Micro-Systems, Inc., 7334 Hollister Ave., Suite B, P.O. Box 2117, Goleta, CA 93118, (805) 968-1387. Inquiry 795.

# Printer Flexes Paper-Handling Muscles

The IBM QuickWriter 24-wire dot-matrix, bidirectional printer is specifically designed to offer impact printing solutions for your word processing, spreadsheet, graphics, and carbon-copy needs.

The optional bin feeder—which automatically adjusts to paper thickness—lets you print pin-feed paper, single sheets, forms, or envelopes without having to manually change the forms.

Quickness is indeed a virtue with a draft speed of 330 characters per second at 10 characters per inch. Letterquality speed is 110 cps at 10 cpi. The QuickWriter works in five pitches—10 cpi, 12 cpi, 15 cpi, 17.1 cpi, and proportional.

Price: \$1699; pinwheel forms feed, \$129; single-bin cut-sheet feed, \$349; dual-drawer cut-sheet feet, \$849; envelope feed, \$299.

Contact: IBM Corp., U.S Marketing and Services Group, 900 King St., Rye Brook, NY 10573, (201) 930-5192.

Inquiry 796.

continued

#### Optical Gigabytes for Your PC

N eed ultra-large, highspeed data storage for your IBM PC, XT, AT, or compatible? Two optical disk subsystems, featuring 1.2 and 2.4 gigabytes of capacity in a WORM (write once, read many) format, are available from N/Hance Systems.

TextScan, a documentstorage and text-retrieval software package, allows you to access data in under 90 milliseconds, on average. Data transfer rate is 6.5 megabits per second. It also uses multitrack buffering to keep up with even the fastest 80386-based systems.

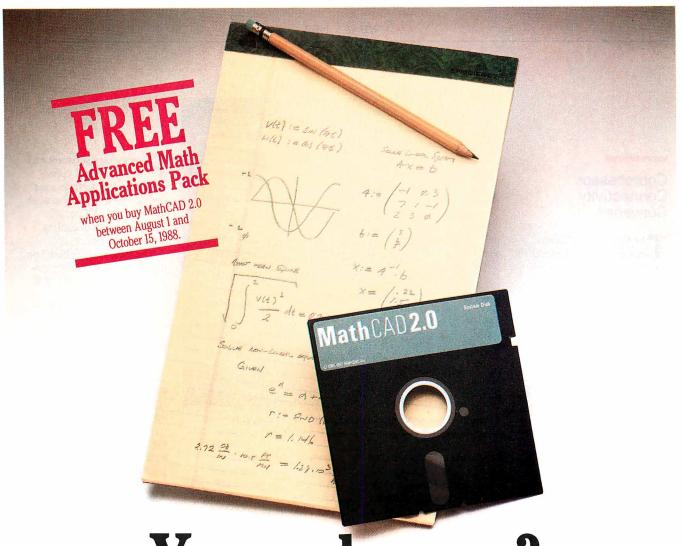
An internal single-drive system, the Model 5120, includes a drive, controller, installation software, and cabling. An external singledrive version of Model 5120 includes a dedicated power supply, a cooling fan, a controller, cabling, and installation software.

Model 5120/2 provides the 2.4 gigabytes of capacity in a single cabinet. The first 1.2 gigabytes is on one side of the cartridge, and the second 1.2 gigabytes is on the flip side.

Price: Internal Model 5120, \$6188; external 5120, \$6388; 5120/2, \$9688.

Contact: Symphony Systems, Inc., N/Hance Systems Division, 908R Providence Hwy., Dedham, MA 02026, (800) 289-9676; in Massachusetts, (617) 461-

Inquiry 794.



Your pad or ours?

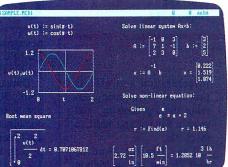
If you perform calculations, the answer is obvious.

MathCAD 2.0.
It's everything
you appreciate about
working on a scratchpad – simple, free-form
math – and more. More
speed. More accuracy.
More flexibility.

Just define your variables and enter your

formulas anywhere on the screen. MathCAD formats your equations as they're typed. Instantly calculates the results. And displays them exactly as you're used to seeing them—in real math notation, as numbers, tables or graphs.

MathCAD is more than an equation solver. Like a scratchpad, it allows you to add



text anywhere to support your work, and see and record every step. You can try an unlimited number of what-ifs. And print your entire calculation as an integrated document that anyone can understand.

Plus, MathCAD is loaded with powerful

built-in features. In addition to the usual trigonometric and exponential functions, it includes built-in statistical functions, cubic splines, Fourier transforms, and more. It also handles complex numbers and unit conversions in a completely transparent way.

Yet, MathCAD is so easy to learn, you'll be using its full power an hour after you begin.

Requires IBM PC® or compatible, 512KB RAM, graphics card.

IBM PC® International Business Machines Corporation.

MathCAD® MathSoft, Inc.

What more could you ask for? How about the new Advanced Math Applications Pack? A \$55 value, it's yours free when you purchase MathCAD between August 1 and October 15, 1988. The Advanced Math Pack includes a custom binder, software and documentation for 16 advanced applications such as:

- Runge-Kutta Solution of First Order Differential Equation
- Solution of Second-Order Differential Equation
- Eigenvalues and Eigenvectors of a Symmetric Matrix
- Convolution and Correlation of Sequences
- · Convolutions using FFT's
- · And many more!

If you're tired of doing calculations by hand or writing and debugging programs, come on over to MathCAD.

For more information contact your local dealer or call **1-800-MATHCAD**, ext. **2775** (In MA: 617-577-1017, ext. 2775).

# **Math** CAD<sup>®</sup>

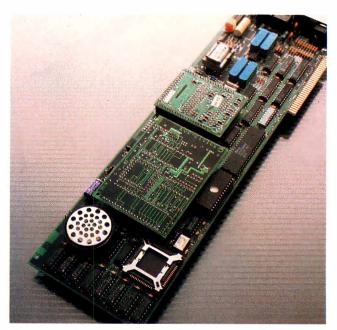
MathSoft, Inc., One Kendall Sq., Cambridge, MA 02139

#### ADD-INS

#### Coprocessor Connectivity Convenes

The Connection Coprocessor board from Intel provides for telecommunications within any compatible data-processing application you now run on your IBM PC, XT, AT, or compatible. Symantec, Microsoft, WordPerfect, and several others have announced that they will be writing a Digital Communications Associates/Intel specification into new versions of their software to make their applications compatible.

With the Connection Coprocessor, you'll be able to continue work on your computer immediately after you've commanded the 10-MHz 80188 coprocessor and 256K bytes of memory to handle facsimile, electronic mail, or other telecommunications file-transfer applications. All you need to do is address the information and press a hot key, according to the company. You can then go back to your application while the



Connection Coprocessor multitasking board from Intel.

board takes care of the communications. Intel says this bypasses the hassle of multitasking operating systems (where background applications can slow or halt foreground applications).

Each Connection Coprocessor has an 8K-byte EPROM to grab the downloadable firmware, a direct memory access (DMA) coprocessor interface to talk to the host, and an expansion socket for a

modem in addition to its microprocessor and RAM. An option is a piggyback card containing a Hayes-compatible 2400-bit-per-second modem.

Price: \$995; modem option, \$295

Contact: Intel Corp., Mail Stop C03-07, 5200 Northeast Elam Young Pkwy., Hillsboro, OR 97124, (503) 629-7354.

Inquiry 784.

#### roprietary software and the Face Card coprocessor let you perform unattended file transfers between any IBM PC, XT, or AT using a modem or cabling within the office.

The Face Card is based on the Hitachi Z80 8-bit microprocessor. It includes 256K bytes of RAM, a 32K-byte EPROM, 300- to 19,200-bps data transfer rates, and an adapter for AC or a backup battery power supply.

The coprocessor lets you do simultaneous telecommunications and data-processing applications; a separate power-source access allows file transfer and receipt even when the computer is turned off.

Price: \$699.

Contact: Face Technologies, Inc., 3711 Plaza Dr., Suite 1, Ann Arbor, MI 48108, (313) 662-8008. Inquiry 785.

#### Mac II Betters Disk and DAT

Southworth Music Systems announced three cards for the Mac II NuBus. They make use of parallel-processing Motorola 56000 signal-processing chips, which enhance A/D (and D/A) applications on a Mac II by 700 times, according to the company.

The boards support compact-disk sample rates of 44.1 kHz and digital audio tape (DAT) sampling rates of 96 and 192 kHz.

The Max Audio Analog card performs all A/D conversion using a proprietary 20-bit A/D and D/A converter, which provides 104-deci-

bel signal-to-noise ratio on playback. The conversion is performed by a custom circuit that samples the input signal 24 million times per second and integrates the data to 192 kHz. The Analog card includes direct-to-disk recording and playback software and real-time stereo spectral analysis software with 64 to 256 bands.

The Max Audio Quad 56000 DSP (digital signal processing) card has shared memory optionally available, including 3 megabytes for storage and audio samples. The enhanced memory aids in applications such as

reverberation and effects processing, frequency-domain audio processing, and sample playing and additive synthesis.

The Digital Audio/SMPTE (Society of Motion Picture and Television Engineers) card can send and receive data in AES/EBU digital audio format for CD and DAT applications.

Price: Analog card, \$1400; Quad DSP card, \$1400; SMPTE card, \$995.

Contact: Southworth Music Systems, Inc., 91 Ann Lee Rd., Harvard, MA 01451, (617) 772-9471. Inquiry 786.

# Flipping Four Floppies Further

mni-Bridge is a halflength board that acts as a floppy disk drive controller to support up to four additional IBM PC, XT, AT, and compatible floppy disk drives.

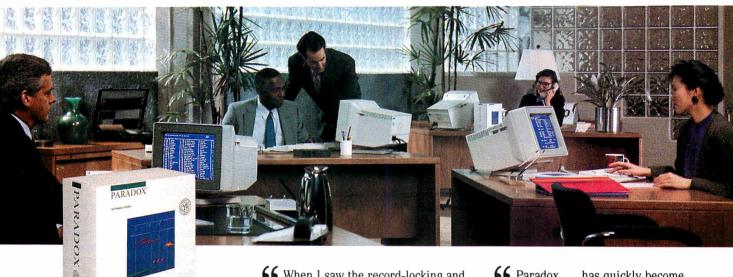
Data transfer rates are 250K, 300K, or 500K bps, allowing for support of any combination of 720K-byte and 1.44-megabyte 3½-inch floppy disk drives, 360K-byte and 1.2-megabyte 5¼-inch floppy disk drives, and QIC-40 standard streaming-tape drives for backing up your hard disk. With your system's existing controller, this controller allows support for a total of six floppy disk drives.

Price: \$95.

Contact: Sysgen, Inc., 556 Gibraltar Dr., Milpitas, CA 95035, (408) 263-4411. Inquiry 788.

continued

# Why Paradox 2.0 makes your network run like clockwork



Paradox\* runs smoothly, intelligently and so transparently that multiple users can access the same data at the same time—without being aware of each other or getting in each other's way.

# With Paradox news travels fast and it's always accurate

Paradox *automatically* updates itself with a screen-refresh that ensures that all the data is up to date and accurate all the time. Record-locking, Paradox-style, safeguards data integrity by preventing for example, two different users from making changes to the same record at the same time.

#### How to make your multiuser network work

To run Paradox 2.0 or the Paradox Network Pack on a network, you need:

- Novell with Novell Advanced Netware version 2.0A or higher
   3Com 3Plus with 3Com 3+ operating system version 1.0, 1.1
- IBM Token Ring or PC Network with IBM PC Local Area Network Program version 1.12 or higher
- Program version 1.12 or higher

  Torus Tapestry version 1.45 or higher
- AT&T Starlan version 1.1 or higher
- Banyan VINES version 2.10
- Other network configurations that are 100% compatible with DOS
   3.1 and one of the listed networks

#### System Requirements for the Network Workstation

- DOS 3.1 or higher
- 640K RAM
- Any combination of hard, floppy, or no disk drives
- Compatible monochrome, color, or EGA monitor with adapter

\*Customer satisfaction is our main concern; if within 60 days of purchase this product does not perform in accordance with our claims, call our customer service departmen and we will arrange a refund.

Paradox is a registered trademark of Ansa Software. Ansa is a Borland International Company, Other brand and product names are registered trademarks or trademarks of their respective holders. Copyright ●1988 Borland International.

When I saw the record-locking and autorefresh in action, I couldn't believe it. Here was a true network application, a program that can actually take advantage of a network to provide more features and functions, things that can't be done with a standalone PC.

Aaron Brenner, LAN Magazine

With Version 2.0, Paradox becomes a sophisticated multiuser product that boasts an impressive selection of data-production features and password-security levels.

Rusel DeMaria, PC Week 99

# Paradox responds instantly to "Query-by-Example"

The method you use to ask questions is called Query-by-Example. Instead of spending time figuring out *how* to do the query, you simply give Paradox an example of the results you're looking for. Paradox picks up the example and automatically seeks the fastest way of getting the answer.

Queries are flexible and interactive. And in Paradox, unlike in other databases, it's just as simple to query more than one table as it is to query one.

**66** The program elegantly handles all the chores of a multiuser database system with little or no effort by network users.

Mark Cook and Steve King, Data Based Advisor 66 Paradox ... has quickly become the state-of-the-art product among PC database managers ... Paradox still reigns supreme as the thinking user's DBMS.

Jim Seymour, PC Magazine 99

# You don't have to be a genius to use Paradox

Even if you're a beginner, Paradox is the only relational database manager that you can take out of the box and begin using right away.

Because Paradox is driven by the very latest in artificial intelligence technology, it does almost everything for you—except take itself out of the box. (If you've ever used 1-2-3\* or dBASE,\* you already know how to use Paradox. It has Lotus-like menus, and Paradox documentation includes "A Quick Guide to Paradox for Lotus Users" and "A Quick Guide to Paradox, it makes your network work.

#### 60-Day Money-back Guarantee\*

For a brochure or the dealer nearest you Call (800) 543-7543



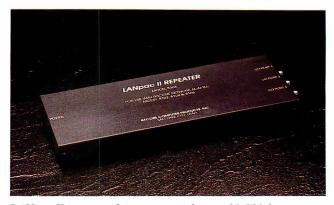
#### HARDWARE . CONNECTIVITY

#### **ESDI File Servers** Get Powerful

ollowing an industry trend to bring more fileserver capabilities to 80386based systems, Comterm introduced a system with an ESDI controller that powers an 80386-based series of file servers to minicomputer-like networking versatility.

ESDI with Comterm controllers allows you up to 2.6 gigabytes of hard disk storage with a sustained throughput of 990K bps and an average access time of 19 milliseconds.

Using Novell's NetWare as the operating system and the industry-standard ARCnet, Ethernet, or token-ring protocols, each machine serves as many users as the respective protocols will support. Each of the three models has 1.2megabyte floppy disk storage capacities and four enclosed LAN software packages: ComShell, E-Mail, LAN Tools, and Notemaker. All the CPUs are 16-MHz 80386s with no wait states.



LANpac II repeaters lets you network up to 10,000 feet away.

There's also an AT-standard 101-key keyboard, a 14inch monochrome monitor, and at least one hard disk drive. Model 4 has 330 megabytes of fault-tolerant disk storage (expandable to 660 megabytes) and 3 megabytes of system and cache RAM. There are two parallel ports, two serial ports, and one ESDI disk controller.

Model 8 has 5 megabytes of system memory plus cache memory, two ESDI disk controllers, one parallel port, and 660 megabytes of formatted capacity.

Model 12 has 7 megabytes of system memory plus cache memory, three ESDI disk

controllers, 1.98 gigabytes of formatted capacity, and one parallel port. Model 12 can have an expanded formatted capacity of up to 2.6 gigabytes, and the company is working on expanding that memory to 4 gigabytes with 10 slots. Price: ARCnet Model 4, \$28,495; Model 8, \$42,995; Model 12, \$76,995. Ethernet models are \$29,495, \$43,995, and \$77,995, respectively. Token-ring models are \$29,995, \$44,495, and \$78,495, respectively. Contact: Comterm, Inc., 110 Hymus Blvd., Pointe Claire, Quebec, Canada H9R 1E8, (514) 694-4332. Inquiry 790.

#### Coaxial Repeater Goes the Distance

ANpac II repeaters from Racore Computer Products extend the distance between networking nodes up to 10,000 feet. "Electronics, power, and a timing shift" allow for sequential placing of up to 10 repeaters every 1,000 feet, the company claims.

The repeater works with the proprietary network LANpac II, which the company says is the fastest network hardware using the most popular networking operating system, Novell NetWare. LANpac II network architecture is either linear, bus, or star.

Data transfer rate is 16 megabits per second over coaxial cabling with a proprietary "high-speed polling scheme," which eliminates the data collisions and the retransmission of data packets made necessary by such collisions in Ethernet networks, for example. The polling can be set at the repeater for every 10, 20, 30, 40, or 50 microseconds.

You select the setting to compensate for propagation delay in the cable, which is partly dependent on cable length. In addition, the repeater can be configured to poll 32 or 64 nodes at once.

Each LANpac II system allows you to connect up to 254 nodes. The repeaters are either stand-alone versions or full-length adapter cards that plug into standard IBM PC. XT, AT, PS/2 Micro Channel, and compatible interfaces, usually within the file server.

Price: Stand-alone version, \$495; PC card version, \$395. Contact: Racore Computer Products, Inc., 170 Knowles Dr., Los Gatos, CA 95030, (408) 374-8290. Inquiry 791.

continued

#### AT&T Enhances Starlan

T&T's Starlan 10 gives you the choice of networking with the already-installed telephone wiring in your building or with the more traditional coaxial cable. All you need is a fulllength PC, XT, AT, or compatible card (or a Micro Channel card for PS/2 connectivity) and a hub.

Adapters, repeaters, and bridges are sold separately, based on your specific networking needs.

Early next year, you'll be able to upgrade all this 10megabit-per-second Ethernet wiring with optical fiber cabling, increasing the maximum possible distance between your PCs and your hub to 3280 feet. Already available are interhub fiber adapters that increase the distance between hubs to 9800 feet (compared to the 328 feet offered by unshielded twistedpair).

But regardless of your wiring choice, Starlan 10 will give you 10-megabitper-second data rates, links to 1-megabit-per-second Starlan networks, links to other Starlan 10 networks, and your choice of operating systems. DOS users will want the DOS Server Program version 3.1.

Software options include a remote PC gateway, an asynchronous gateway, gateways for connection to IBM Standard Network Architecture (SNA) mainframes, network routers for connection to remote networks over X.25 facilities, and certain terminal-emulation programs for connectivity to proprietary terminals.

Price: Network hub unit, \$1895; twisted-pair or coaxial PC or PS/2 board, \$495; adapter for twisted-pair connection from an Ethernet card, \$200; fiber interhub adapter, \$500; each 1:10 bridge, \$4500; each 10:10 bridge, \$7000.

Contact: AT&T Data Systems, One Speedwell Ave., Morristown, NJ 07960, (800) 247-1212. Inquiry 789.



# **EmulateThe Best** With The Brightest.

There's no denying the availability of some outstanding dedicated terminals to access Digital, Hewlett-Packard, and Data General host systems. Which makes the task of precisely emulating the performance of those dedicated terminals on an IBM® PC or compatible a rather significant challenge.

Based on the feedback we've received from SmarTerm® users, our family of terminal emulation software has met the challenge, passed every test, and surpassed, in the opinion of a host of enthusiastic users, the performance of the host system terminals being emulated.

The reasons why we shine are fundamental.

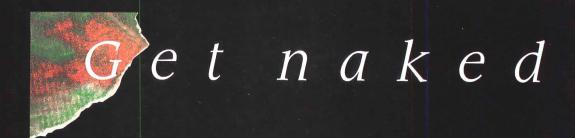
Every SmarTerm emulation is precise. So precise, in fact, that a dedicated terminal's SmarTerm counterpart fully emulates not only advanced performance features but also unique terminal quirks and bugs.

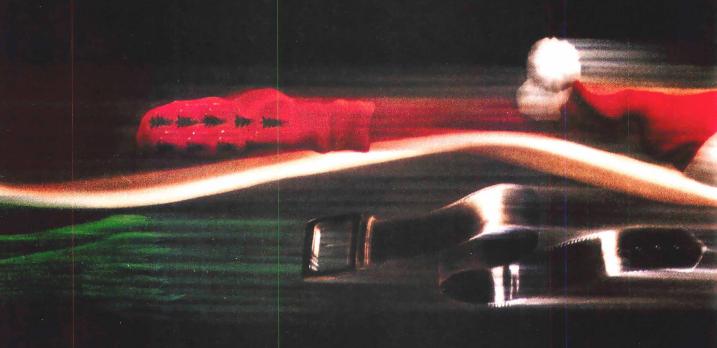
Every SmarTerm emulation is easy to use. It's one thing to make software do what hardware does. It's another challenge to minimize software's human wear. The people designing our products understand the nature of the people using them.

Every SmarTerm emulation is easy to learn. These days, training costs are a hot topic. Software intended to boost overall system efficiency must recognize the value of learning speed. We have.

It's also easy to learn more about how SmarTerm emulations can help you shine. Your software dealer can supply all the details. Or you can contact us at (608) 273-6000 to request complete specifications and a demonstration disk of the SmarTerm emulation that precisely matches your requirements.

© 1988 Persoft, Inc., 465 Science Drive, Madison, Wisconsin 53711 U.S.A. Persoft and Smafferm are registered trademarks of Persoft, Inc. All Rights Reserved. IBM is a registered trademark of International Business Machines Corporation. Digital is a registered trademark of Digital Equipment Corporation. Data General is a registered trademark of Data General Corporation.





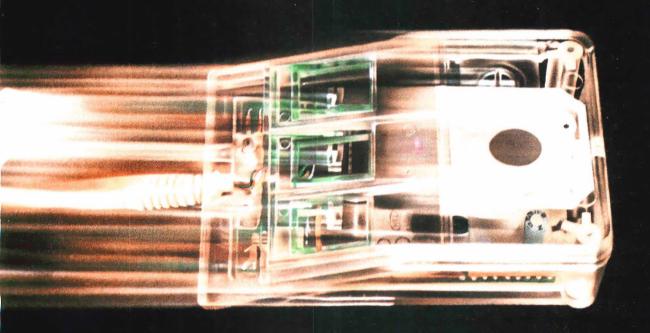
# ClearCase™Mouse—Special Edition From Logitech.

To celebrate the shipment of our two millionth mouse, we took the covers off our winning technology.

But this mouse is a lot more than just a pretty case. It's compatible with virtually all mouse-based programs, plus you can program it to "mousify" any keyboard-based application. And it doesn't need resetting when you switch programs.

High resolution, adjustable cursor control, and a programmable 9,600 baud rate let you move the cursor quickly and accurately, even on detailed graphics—perfect for applications

# for Christmas.



like PaintShow™ which, it so happens, comes with your ClearCase Mouse.

You get everything for \$149. The package includes: the Logitech ClearCase Mouse for IBM PC, XT, or AT and PS/2 or 100% compatibles; a 9-25 pin adapter; Plus Package™ software; and Logitech PaintShow™ (which requires a graphics card).

Pick up the ClearCase Mouse at your computer dealer, or call: **800-231-7717**. (In California call **800-552-8885**.)



Circle 146 on Reader Service Card (DEALERS: 147)

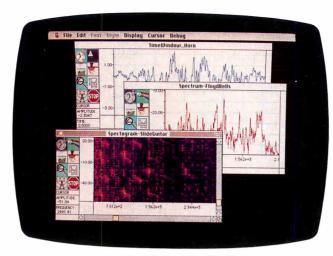
#### HARDWARE • OTHER

#### MFLOPS Help Mac Il Process Digital Signals

floating-point accelerator card for the Mac II allows it to acquire data at up to 125 kHz and can operate on that data using signal-processing functions and display the results in real time. For example, a spectrogram function can display the "bending" frequency components of a slide guitar in real time while you listen to a compact disk recording.

The MacDSP board (with accompanying software) is available in three speeds: 8 MFLOPS, 12.5 MFLOPS, and 25 MFLOPS. It's based on AT&T's DSP32 floating-point digital-signal processor, and it lets you observe the functions as they're applied.

The board supports more than 10 signal-processing



Acquire data at 125 kHz with the MacDSP board.

functions, including fast Fourier transforms, spectral averaging, and elliptic IIR filters. The functions can be applied to incoming data. data stored in main memory, and data on your disks. Data can be manipulated in both analog and digital formats.

You can display data in several formats, including magnitude, phase, color spectrogram, and waterfall.

Log scaling, zoom, and maximum amplitude hold are features that can be performed with standard Macintosh menus. Multiple windows allow you to compare the results of a variety of operations.

AT&T's DSP32 C compiler and simulator provide software support, and the board uses firmware for access to processor registers from

Macintosh driver functions. Custom signal processing can also be developed and directly downloaded onto the card.

Price: 8-MFLOPS version with driver software and 64K bytes of RAM, \$2249; 12-MFLOPS version, \$2745; 25-MFLOPS version, \$3241; 125-kHz programmable 16-bit A/D and D/A card, \$486; DSP software package, unbundled, \$496.

Contact: Spectral Innovations, Inc., 292 Gibraltar Dr., Suite A-4, Sunnyvale, CA 94089, (408) 734-1314. Inquiry 798.

# **Digital Waveform**

p to 20 million samples per second can be taken with the R2000M, a 128Kbyte PC-based oscilloscope. An IBM PC, XT, AT, or compatible needs only 640K bytes of RAM, graphics suples (with color graphics emulation), and a free expansion

The R2000M is particuclaims, in applications requiring high-speed A/D conversion. It can replace traditional oscilloscopes for transient, vibration, modal, and shock waveform analysis.

Features include an 8-bit A/D converter for each channel with a low front end; 50ohm input switchable to one million ohms; softwareselectable gains from 10 millivolts per division to 50 volts per division; and an optional real-time fast Fourier transform and general-purpose interface bus (GPIB) interface. Price: \$3995.

Inc., 433 North 34th St., Seattle, WA 98103, (206) 547-8311.

Analysis on the PC

port of CGA, EGA, or Hercularly useful, the manufacturer

Contact: Rapid Systems,

Inquiry 811.

#### Virtual 80386s Run from Host CPU

he UnTerminal, an add-in board from Advanced Micro Research, and PC-MOS/386, a virtual MS-DOS from The Software Link, together allow you to run multiple multitasking workstations from a single 80386-based machine.

Such a distributed concept is based on the fact that the Intel 80386 chip, when combined with specialized software, creates a virtual PC for running multiple DOS applications under the Unix operating system. Unix provides the platform for multiuser applications such as database management, word processing, and communications.

PC-MOS/386 allows the host CPU to run all off-theshelf DOS applications for any of the virtual PCs. The boards take the multitasking capabilities of the 80386 microprocessor and distribute them via 25-pin copper cabling to as many as 16 virtual PCs in the form of keyboard/monitor units. You can locate each keyboard/ monitor unit as far as 500 feet from the 80386 host to obtain 16-megabit-per-second connectivity.

A single full-length board (with as many as three daughterboards) fits an AT or compatible slot and supports four keyboard/monitor units as workstations adjunctly to the main CPU. With a 20-MHz system, four adjunct users and a host user taking full advantage of each workstation will slow down each person's virtual processing to about 4 MHz.

As many as four full-

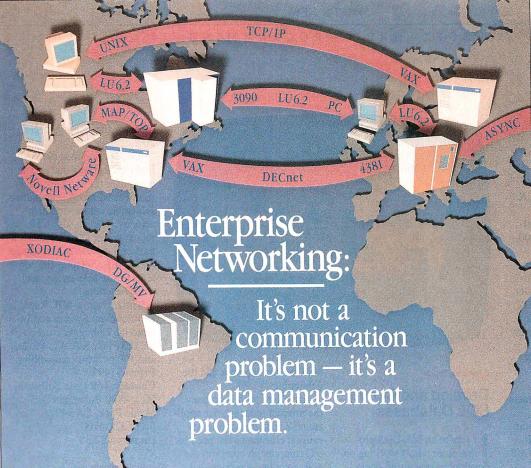
length boards can be placed in a single 80386, supporting a total of 12 daughterboards, with each board supporting one workstation. Supporting this maximum of 16 users would slow down a 16-MHz CPU to virtually 1 MHz at a theoretical maximum load.

Price: Full-length DOS Un-Terminal board, \$745; DOS daughterboard, \$379; fulllength Unix UnTerminal board, \$895; Unix daughterboard, \$425. Boards that fit Unix CPUs are also available, as are the 80386-based systems from which you can network the workstations.

Contact: Advance Micro Research, Inc., One Lagoon Dr., Suite 100, Redwood City, CA 94065, (415) 594-9991.

Inquiry 810.

continued



RACLE® isn't just the world's best data management system, it's the only system that runs on mainframes, minicomputers and PCs—the only system that can integrate all your computers and all your data into a single enterprise-wide network.

You've invested a lot of money in communication controllers, satellite links and wire to connect your computers. Yet, to access data located on any computer other than the one to which you are directly connected, you still have to:

- Know which computer has the data you want
- Know how to use a terminal emulator to log onto that computer
- · Know how to use a file transfer program to bring your data over

Enterprise networking must provide easy access to data anywhere in the network. Only ORACLE makes this possible, today. Only ORACLE runs on all your computers, today. Only the ORACLE distributed DBMS provides you with transparent access to data on

every computer on the network.

If your users know nothing about communications or networks, ORACLE will help keep it that way.

SQL\*Star™ is Ôracle's open systems architecture for enterprise networking. It allows you to integrate all your computers, operating systems, networks—even different DBMSs-into a single unified computing and information management environment. With SOL\*Star, your users can unite information on PCs, minis and mainframes across all your local and wide-area networks. ORACLE's open systems design even allows you to transparently

ORACLE access IBM's SQL/DS and DB2.

PRESENTATIO

SESSION

TRANSPORT

NETWORK

DATA LINK

PHYSICAL

If you purchase or write software that interfaces at the wrong level (lower than OSI Level 7), you have a network-dependent application. Applications built using ORACLE are network independent.

# at the right level

Are you unsure which or how many networks your company will ultimately settle on? Do you have LU6.2, DECnet, TCP/IP. asynchronous lines, 3270 data stream, MAP/TOP, Novell Netware, 3+? ORACLE supports them all.

Has your network changed in the past? Might it change in the future? Applications built using ORACLE won't change a bit.

largest supplier of data management

software and services, and the only supplier of enterprise-wide networking and data sharing. Oracle's consulting and support services will insure troublefree operation anywhere in the world

To register for the next free ORACLE seminar in your area, call or write today.

# **ORACLE** solves problems

Banyan VINES, LAN Manager, 3COM

Oracle Corporation is the world's

#### CANADIAN SEMINARS

**U.S. SEMINARS** Birmingham Little Rock... Phoenix.....

Sep 22, Nov 10
Sep 8, Oct 6, Nov 3
Sep 14, Oct 11, Nov 9
Sep 20, Oct 26, Nov 17

Sep 22, Oct 27

Nov 15
Sep 16,
Oct 21, Nov 18
Oct 18
Oct 19
Sep 14
Sep 7, Oct 5, Sep 14

Sep 15, Oct 11, Nov 16
Sep 14, Nov 9
Oct 13, Nov 17

Sep 15, Nov 2
Oct 5
Oct 4
Sep 20
Sep 15, Oct 13, Nov 17
Sep 15, Oct 4, Nov 22

 Columbus
 Sep 12

 Oklahoma City
 Sep 13

 Tulsa
 Oct 25

 Portland
 Sep 8, Nov 15

 Harrisburg
 Sep 26

 Philadelphia
 Sep 19, Oct 26, Nov 18

 Pittsburgh
 Oct 26

 Valley Forge
 Sep 8, Nov 10

Sep 22, Nov 10 Sep 20, Nov 9

Nov 16 Oct 19 Sep 14 Nov 9

Sep 7, Oct 4, Nov 2 Nov 9

Sep 8, Oct 6, Nov 10

Sep 14, Oct 20

Oct 12, Nov 29

Sep 13, Nov 10

Tucson ..... Costa Mesa Los Angeles Oakland

Sacramento

San Jose CO

FL

San Diego .... San Francisco

Colorado Springs Farmington
New Haven
Stamford
Washington (Federal)

Ft. Lauderdale.

Atlanta

Des Moines

Wichita KS KY Lexington . Louisville .

New Orleans Shreveport Boston ....

Iselin ...

Princeton. Albuquerque Las Vegas .... Albany ...... Buffalo .....

Akron .... Cincinnati Cleveland Columbus

OK Oklahoma City

Portland.

Greenville

Memphis

Amarillo

ıstin Dallas

Dallas
Ft. Worth
Houston
Midland
San Antonio
Salt Lake City
Norfolk (Federal)

Richmond

Burlington.

pokane

Madison

Seattle

Boston
Burlington
Springfield
Bethesda (Commercial)
Baltimore
Portland
Detection
Son 13 

To register for Canadian seminars, please call the office nearest you: Calgary 403-265-2622, Ottawa 613-238-2381, Quebec 514-337-0755, Toronto 416-596-7750.

Calgary	Sep 15, Nov 17
Edmonton	Oct 6
Halifax	Oct 13
	Sep 16
London	Oct 20
Montreal	Sep 28, Oct 26, Nov 23
Ottawa	Sep 1, Oct 6, Nov 3
Ouebec	Sep 7, Oct 5, Nov 2
Regina	Sep 22
Saskatoon	Nov 10
Toronto	Sep 13, Oct 11, Nov 8
Vancouver	Sep 8, Nov 10
Victoria	Nov 24
Winning	Oct 20

**COMPATIBILITY · PORTABILITY · CONNECTABILITY** 

Copyright © 1988 by Oracle Corporation ORACLE is a registered trademark and SQL\*Star is a trademark of Oracle Corporation.
The other companies mentioned own numerous registered trademarks

Call 1-800-345-DBMS, ext. 149 today.

20 Oavis Drive, Belmont, CA 94002 • World Headquarters (415) 598-8000 • Calgary (403) 265-2622 • Ottawa (613) 238-2381 • Ouebec (514) 337-0755 • Toronto (416) 596-7750 • ORACLE Systems Australa 61-2-999-0800 • ORACLE Europe 44-1-948-6911 • ORACLE Systems Hong Kong 852-5-266846

Attn: National Seminar Coordinator Oracle Corporation • 20 Davis Drive Belmont, California 94002
My business card or letterhead is attached. Please enroll me in

REE ORACLE seminar to
ld

on:

RYTE

#### A RAT for A/UX

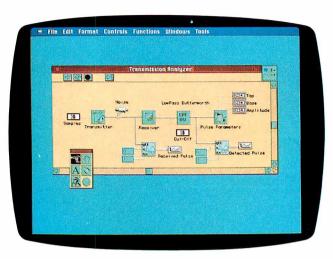
new FORTRAN compiler for Apple's A/UX Unix environment uses a technology originally developed for the Motorola 88000 that Absoft has dubbed "RAT" (for RISC Architecture Technology). The company claims that the compiler takes maximum advantage of the Mac II's 68020 register set and executes programs an average of 30 percent faster than other Unix-based FORTRAN compilers.

It's called MacFortran/ AUX, and Absoft says it meets full ANSI FORTRAN 77, IEEE P754, and military standard 1753 specifications. It also supports most VAX/VMS FORTRAN extensions, as well as many of the extensions of FORTRAN 8X, Complex\*16, and Namelist.

The compiler gives you full access to Unix and the Macintosh Toolbox. It also supports interlanguage calling with C. Although MacFortran/AUX has a standard Unix-style command-line interface, it also comes with a Macintosh-style graphical interface that's written completely in FORTRAN. Absoft even provides the source code, which includes over 150 Toolbox calls.

The company also says it's working on a version of the RAT compiler that will run under Macintosh Programmers' Workshop 3.0 on 68020/68030-based Macs. Absoft claims the current and future versions of the RAT compiler will be 100 percent source-compatible with prior versions of FORTRAN and with each other.

Price: \$495. Contact: Absoft, 2781 Bond St., Auburn Hills, MI 48057, (313) 853-0050. Inquiry 751.



#### Develop and Debug SQL Databases

f you're an MS-DOS programmer who's working on developing structured query language (SQL)-based database applications, Informix has a "fourth-generation" product that will make your life easier. The Informix-4GL Rapid Development System and Interactive Debugger, as its name implies, lets you do

both the development and the debugging.

According to the company, the product reduces your application development time because it eliminates the need for a C compiler. It compiles the 4GL code into a p-code that you can execute with an included p-code runner. You can then use the interactive debugger to find and correct any programming errors. There's also a built-in option that lets you take advantage of up to 16 megabytes of extended

memory for creating larger applications.

The development system includes features that let you customize the end-user environment with pop-up windows, selectable colors, and help screens. There's also a flexible report writer. The interactive part of the package lets you set breakpoints, display the contents of variable arrays, and trace functions.

The Informix-4GL Rapid Development System and Interactive Debugger runs on the IBM PC, XT, AT, PS/2s, and 100 percent compatibles. **Price:** \$1495.

Contact: Informix Software, Inc., 4100 Bohannon Dr., Menlo Park, CA 94025, (415) 322-4100. Inquiry 752.

#### Fast Prolog for Your Mac

pplied Logic Systems has ported its ALS Prolog to the Macintosh environment, retaining its incremental interactive compiler. When you're using ALS Prolog, the compilation step is completely transparent; you interact with the system using text editor windows just as if you were using an interpreter. There's also a built-in debugger.

For Mac aficionados, the company has added a programmer's interface to Quick-Draw and a graphics window for making pictures with Prolog.

To run ALS Prolog, you'll need a Mac Plus, SE, or II, Apple's 128K-byte ROM, and a minimum of a megabyte of RAM. A hard disk drive is recommended.

Price: \$349.

Contact: Applied Logic Systems, Inc., Box 90, University Station, Syracuse, NY 13210, (315) 471-3900. Inquiry 753.

continued

#### A Bumper Crop of C Functions

or those C programmers who don't want to keep reinventing the wheel, Greenleaf Software is offering SuperFunctions, a library of nearly 400 functions for advanced programmers. All functions come with complete source code.

SuperFunctions features routines that give you access to as much as 32 megabytes of Lotus/Intel/Microsoft (LIM) expanded memory version 4.0, and access to high-level DOS functions such as the critical error handler. There's also an advanced set of time-and-date functions that include project-scheduling support, as well as bit-field structures

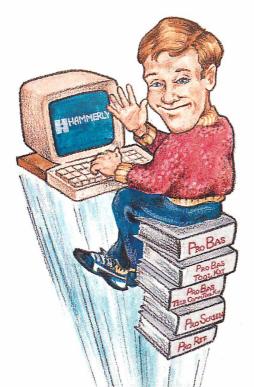
that compress temporal variables into 16- or 32-bit words for saving space when you're doing database development work.

There are also device-independent menu-creation options that include overlaid windows with automatic screen refresh when the windows are removed.

You can use SuperFunctions with any IBM PC, XT, AT, PS/2, or compatible. You'll also need MS-DOS 2.0 or higher.

Price: \$265.

Contact: Greenleaf Software, Inc., Bent Tree Tower Two, Suite 570, 16479 Dallas Pkwy., Dallas, TX 75248, (214) 248-2561. Inquiry 754.



# Five easy ways to boost your BASIC

**Professional Basic Programming Library** 

Probas is a library of 232 routines that kicks BASCOM and QuickBASIC into 5th gear and gives you powers and abilities far beyond those of mortal men. So much for the hype, now down to brass tacks:

- 600 page 3-part manualFull-featured windowing
- Screen snapshots
- Virtual screens in memory
  Lightning-fast file I/O
- Full mouse support

Plus over 200 essential services from directory and equipment routines to handy string, date, time, and input routines. For all versions of QuickBASIC and BASCOM including BASCOM 6.0 for OS/2. Just \$99.00!

On-Line Help For ProBas

PROREF is a pop-up help system for the 232 routines in PROBAS, pop-up help for your routines, and an extension of the QuickBASIC programming environment. See the calling syntax and help for any ProBas routine, or any of your routines, with just a few keystrokes or mouse clicks. Pop-up and ASCII chart, calculator, keyboard scan code module or almost any DOS program via hot-key. Just \$50.00!

# $P_{\mathbf{RO}} \mathbf{B}_{\mathbf{AS}_{\mathsf{TM}}}$

The ToolKrr is a collection of assembly and BASIC modules that use the ProBas library to save you even more hours of grunt work. Why spend hundreds of hours re-inventing the wheel when you can just plug in **ToolKrr** modules like:

- Menu Generators
- Fast B-tree indexing
- Mini-editor with word-wrap
- Patch .EXE files
- Protected storage areasJulian date routines

Plus clock, calendar, BCD math routines, and much more. Complete with BASIC source code and comprehensive manual. The ProBas adds capabilities and helps conserve your most valuable asset of all, time! Requires ProBas. Just \$99.00!

# $\mathbf{CREEN}_{\mathsf{TM}}$

**Professional Screen Management System** 

PROSCREEN is a full-featured screen generator/editor that will save you more design and coding time than you ever thought possible. PROSCREEN works with screens like a word processor works with text to provide complete control over screen characters, placement and colors. PROSCREEN comes with subroutine source, extensive on-line help and a 285 page manual with tutorial and reference. Just \$99.00!

## Pro Basta **TELECOMMTOOLKIT**

The ProBas TeleComm ToolKit is a collection of high-level communications modules that you plug into your code to provide popular file transfer protocols, terminal emulations, login scripts and baud rates up to 57,600 bps. You get:

- Xmodem/Modem7/Xmodem-1k
- Ymodem (single and batch)
- CRC-16 and Checksum
- VT52, VT100, ANSI BBS etc.
  Auto Dialer & data base
  Documented BASIC source

Why use clumsy SHELLs to complex terminal programs when you can plug just the communications routines you need into your code? Implement just the features, and commands you want. Requires ProBas. Just \$75.00!

Our thirty day, money-back guarantee assures you the highest quality and our technical support staff is always ready to help. Try our BBS at (301) 953-7738 or give us a call at:

# HAMMERLY

COMPUTER SERVICES, INC.

8008 SANDY SPRING ROAD . LAUREL, MD 20707

(301) 953-2191

Add \$3.00 per item (\$7.00 Canada) for shipping. Trademarks ProBas, ProRes, ProScreen: Hammerly Computer Services, Inc. QuickBASIC, BASCOM: Microsoft Corp.

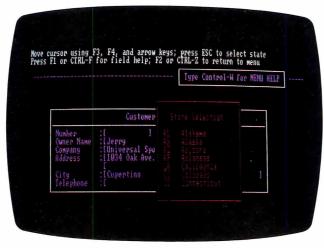
#### LabView Forges Ahead

Persion 2.0 of National Instruments' LabView system for the Macintosh has added a number of new features. Designed as a general-purpose tool for data acquisition, analysis, and instrument control, LabView is an icon-based graphical programming system.

Among the new features are color support, a run-time system for distributing applications, integer data type support, and MultiFinder background execution. Also added is a compiler, which the company claims makes LabView run up to 10 times faster than the previous version. Unlike version 1.2, which interpreted the graphical program, version 2.0 generates machine code directly from the block diagram. National Instruments claims that I/O-intensive applications execute three times faster, and computationintensive benchmarks run up to 60 times faster.

LabView 2.0 also has perked up editing capabilities that include diagram rubberbanding, complete Clipboard cut and paste, multiple-object selection, and the ability to drag objects between windows. To increase flexibility in evaluating graphical results, there's an interactive pan and zoom with cursor control. On a Mac II, you can set the color of plot traces, icons, backgrounds, and scroll areas.

LabView 2.0 has added Chebyshev and Butterworth low-pass and high-pass filters and additional numerical methods routines to the existing digital signal processing and statistical analysis routines in the library. The program runs on the Mac Plus, SE, and II. If you already own LabView 1.2, you can upgrade to version 2.0 at no charge.



LabView 2.0 has a raft of new features.

Price: \$1995.

Contact: National Instruments, 12109 Technology Blvd., Austin, TX 78727, (800) 531-4742; in Texas, (800) 433-3488. Inquiry 757.

# FANSIM Works with Frequency

ANSIM is short for frequency analysis and simu-

#### A Solid Diet for AutoCAD

f you've had enough of wire-frame CAD and want something more substantial, Autodesk is now shipping AutoSolid, a solidmodel CAD package that uses both constructive solid geometry (CSG) and boundary representation modeling techniques. The package is based on PADL, the University of Rochester's Parts and Assembly Description Language. Autodesk has rewritten PADL in C, making it, the company claims, portable and more efficient.

Autodesk says that because of its intuitive user interface and CSG modeling techniques (analogous to the way mechanical designers work), AutoSolid is easy to use. Pop-up menus guide you through system operations, and you can get on-line help at any point. You can construct a model using solid primitives that you combine using Boolean operations. The finished model is then generated by

using sweep techniques.

AutoSolid has DXF and IGES file-transfer capabilities that let AutoCAD and other design packages use its data. The link is bidirectional, letting you transfer solid models to AutoCAD for design detailing and drafting. You can also transfer AutoCAD two-dimensional profiles to AutoSolid, where you can use them to create solid models with the package's revolution and extrusion capabilities.

To use AutoSolid, you'll need an IBM PC AT, Compaq 386, or compatible hardware running Santa Cruz Operations' version 2.2 Xenix. Autodesk says future releases of the product will support other hardware and operating systems, including Sun and Apollo.

Price: \$5000.

Contact: Autodesk, Inc., 2320 Marinship Way, Sausalito, CA 94965, (415) 332-2344.

Inquiry 758.

lation. It provides frequency analysis of open-loop and closed-loop response, finds transfer functions of real or simulated systems, and also finds poles or zeros.

With FANSIM, you can take real data, simulated data, or internally synthesized functions to find overall frequency response. The program will also accept or output different forms of frequency response functions.

FANSIM runs on the IBM PC and compatibles. It requires a math coprocessor and a Hercules, CGA, or EGA display. You'll also need at least 330K bytes of free RAM, although 512K bytes is recommended.

Price: \$395. Contact: Tutsim Products, 200 California Ave., #212, Palo Alto, CA 94306, (415) 325-4800.

Inquiry 760.

## An Algebra Library for C

f you're an engineer or scientist who does extensive programming in C, C-LIN will make your job easier. It's a library of linear algebra subroutines that, according to its maker, have been written specifically to take advantage of the array-manipulation characteristics of C.

The C-LIN library consists of 42 functions, 40 of which come in both single-and double-precision versions. It's available in both compiled and source code versions. The compiled versions are available for Borland Turbo C and Microsoft C.

**Price:** Compiled version, \$69; source code version, \$140

Contact: JAYAR Systems, 253 College St., Suite 263, Toronto, Ontario, Canada M5T 1R5, (416) 751-3284. Inquiry 761.

continued

	YES	I want to know Office Netwo	w more about the Commrk.	ix 32
	SEN	D ME	more product informati learn how the Commix	on so I can can help me.
	HAV	a sales r benefits f	representative call me turther.	o discuss the
Name				
Title _				
Compa	any			
Teleph	none			
Addres	SS			
City			State	Zip



130 GAITHER DRIVE SUITE 116 MT. LAUREL, NJ 08054 (609) 722-5575 (800) 423-8044



NO POSTAGE NECESSSARY IF MAILED IN THE UNITED STATES

#### **BUSINESS REPLY MAIL**

FIRST CLASS PERMIT NO. 130 MT. LAUREL, NJ

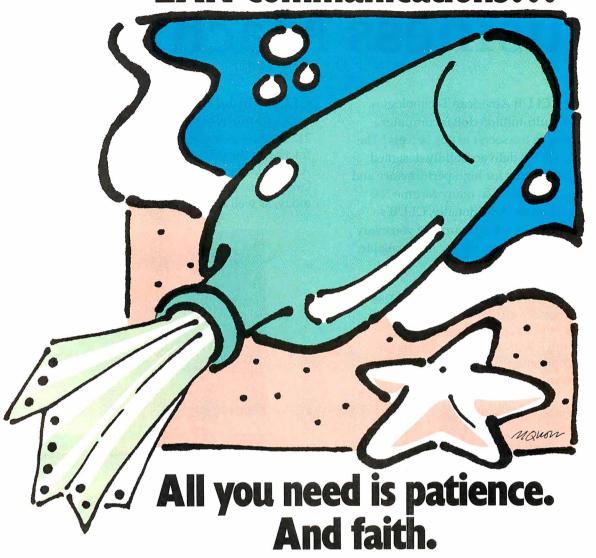
POSTAGE WILL BE PAID BY ADDRESSEE



130 Gaither Drive, Suite 116 Mt. Laurel, NJ 08054-9983



# You can rely on a file server for LAN communications...



You're getting the drift of this message already. File servers aren't designed to solve the PC user's communications problem. But now there's a system that is.

#### Now there's COMMIX™32.

It's a general purpose local area network for PCs and minicomputer hosts. It connects you with the host, other PCs, and peripherals such as printers, plotters, or modems through simple, pop-up menu commands.

For file transfer and E-mail as a background task. For printer spooling and sharing directly from your applications programs. For terminal emulation that's automatic. COMMIX 32 will let anyone perform common LAN tasks—without the need for expert assistance.

#### Install it quickly. Expand it easily.

Almost any PC user can install and connect with COMMIX. With each connection, you're saving time and money. Because each COMMIX connection costs as little as \$150.

Then take advantage of expansion possibilities. With our optional Ethernet® Link Module, you can create larger LANs with thousands of users. And through our optional Wide Area Network Module, distant COMMIX LANs can appear as one network.

#### If you're lost at sea.

And looking for solid LAN. The COMMIX 32 is available now. Send us a message: ITRON, a Division of Infotron Systems Corporation, 130 Gaither Drive, Suite 116, Mount Laurel, NJ 08054.

TEL: (609) 722-5575 FAX: (609) 234-0451 In the United Kingdom: (01) 735-0731

In Europe: (2) 725-0770





Circle 124 on Reader Service Card

# The Ultimate **Business Machines**

In just three years, CLUB American Technologies has grown into a multi-million dollar computer manufacturer. What's the secret to our success? The answer is simple, CLUB delivers solidly designed systems which are famous for high performance and superior quality. That's why so many fortune 500 companies depend on us. Additionally, CLUB's on-line engineers are available to support you every business day with optional on-site service available.

#### **CLUB Model 200 Series**

The Model 200 Series are OS/2 compatible, 80286 based systems. They are available in either 8 or 10 MHz versions to fit your specific needs. These economical, yet full featured AT compatibles are perfect for any applications such as spreadsheets and word processing.



#### Model 200 Series Features & Pricing

Intel 80286 CPU -208/208S-6/8MHz, 210/210S-8/10MHz, 211-8/10MHz '0' wait state, 512K DRAM, 1.2MB Floppy Disk Drive, 80287 Math Coprocessor Socket, HD/FL Controller (controller is built-on motherboard for 'S' Models) Keyboard Speed Switchability ('S' Models), 2 Serial/1Parallel Ports (211), 192

200 Series	with N	Monitor and Adap	iter
Model with Hard Disk	Mono	EGA	VGA
208 or 208S with 20MB	\$1275	\$1625	\$1875
208 or 208S with 40MB	\$1420	\$1770	\$2020
210 or 210S with 20MB	\$1705	\$2065	\$2305
210 or 210S with 40MB	\$1850	\$2210	\$2450
211 with 20MB	\$1805	\$2165	\$2405
211 with 40MB	\$1950	\$2310	\$2550

#### **CLUB Model 212 Series**

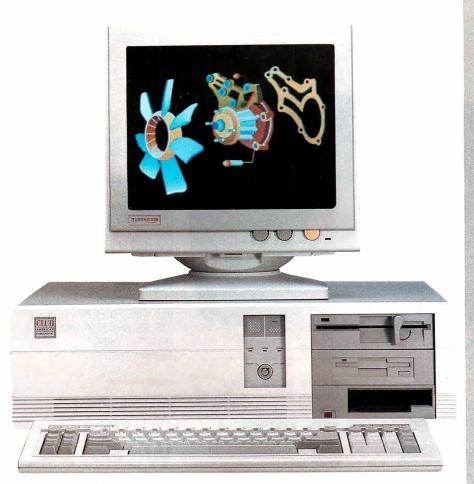
With an effective throughput of 16 MHz, the Model 212 Series is as fast as many 386 machines at a fraction of the price. Compatibility with the existing AT standard ensures that the Model 212 will run your large databases, and complicated financial software today, as well as OS/2 applications tomorrow.



#### Model 212 Series Features & Pricing

Intel 80286-8/12, 1MB of DRAM, 1.2MB Floppy Disk Drive, 1:1 Interleave HD/FL Controller, 80287 Math Coprocessor Socket, Clock/Calendar/ Configuration with Battery Backup, Reduced Chassis (212D), 192 Watt Power Supply, 101 Key Enhanced Keyboard, Complete Documentation, and more

212 Series	with N	Monitor and Adap	oter
Model with Hard Disk	Mono	EGA	VGA
212 with 40MB	\$2250	\$2615	\$2850
212 with 70MB	\$2505	\$2870	\$3105
212D with 40MB	\$2190	\$2550	\$2790
212D with 70MB	\$2445	\$2805	\$3045



#### **CLUB Model 300 Series**

The Model 300 Series 80386 microprocessor's state of the art design brings mainframe capability to the desktop at a vastly lower cost per seat. Complete compatibility with OS/2 and Unix give the Model 300 Series the ability to meet the most demanding multi-user and multi-tasking applications. Let CLUB give you the key to increased productivity in todays complex office and engineering environments.

#### **Model 300 Series Features & Pricing**

Intel 80386 CPU - 8/20 (320), 8/16 (316S), 1MB 32-bit DRAM (320), 1MB DRAM (316), 1.2 MB Disk Drive, 1:1 interleave HD/FL Controller (320), HD/FL Controller (316S), 80387 Math Coprocessor Socket (320), Weitek Support (320), 80287 Math Coprocessor Socket (316), 8 expansion slots, Clock/Calendar/Configuration w/battery backup, 192 Watt Power Supply, 101 Key Keyboard, Dcocumentation, and more.

300 Series	with Monitor and Adapter		
Model with Hard Disk	Mono	EGA	VGA
316S with 40MB	\$2690	\$3050	\$3420
316S with 130MB	\$4060	\$4420	\$4790
320 with 70MB	\$4005	\$4330	\$4675
320 with 130MB	\$5120	\$5445	\$5790

#### **CLUB Model 110**

The Model 110 is an affordable entry level computer. It's perfect for general business applications and for low cost network nodes.



#### Model 110 Features & Pricing

Intel 8088 CPU-4.77/10 MHz, 256K RAM Maximum 640K, Floppy Disk Drive and Controller, 8 Expansion Slots, 150 Watt Power Supply, 101 Key Keyboard, Documentation and more

100 Series	with N	lonitor and A	dapter
System & Hard Disk	Mono	EGA	VGA
110 with 20MB	\$895	\$1255	\$1495
110 with 40MB	\$1080	\$1440	\$1680

#### Peripherals

For your convenience, we offer the latest peripherals to enhance your systems. Our manufacturing facilities are geared to build systems the way you want them. Call and tell us what you need. Here's a list of just some of the products we carry.

 Storage.
 \$95

 Floppy Drives: 5.25" - 1.2MB
 \$95

 5.25" - 360K
 \$85

 3.5" - 1.44MB
 \$120

 3.5" - 720K
 \$105

 Tape Backups: Internal: 40MB
 \$580

 60MB
 \$650

 125MB
 \$995

 External: 40MB
 \$620

60MB ....
Multifunction & Memory
(all prices with 0K)

 384K memory card for XT
 \$99

 576K memory card for XT
 \$42

 2MB multifunction card for AT
 \$110

 3MB extended memory card for AT
 \$150

 2MB EMS card for AT
 \$150

 2MB EMS card for AT
 \$75

 Mini I/O for XT and AT
 \$75

 Mini I/O w/ floppy controller for XT
 \$85

 80286 accelerator card for XT
 \$299

Modems

1200/300 Baud rate internal . . . . . \$99 2400/1200/300 Baud rate internal . . . \$175 2400/1200/300 Baud rate external . . . \$210 1200/300 Baud pocket Mini Modem . \$139 \* All modems come with Bitcom software

Printers

 Star Micronix NX 1000 9 pin
 \$199

 Star Micronix NB-24-10 24 pin
 \$493

 Epson FX 1050
 \$595

 HP Laser Jet
 \$1815

 Products for PS/2

 RAM 4000 (EMS) card OK
 \$399

 60MB Tape backup internal
 \$1095

 60MB Tape backup external
 \$1285

 120MB Tape backup external
 \$1595

 PS/2 modem 2400 baud internal
 \$299

Others

 80287-8
 \$230

 80287-10
 \$279

 80387
 Call

 Ram chips
 Call

 Logitech Mechanical mouse
 \$79

 Optical mouse
 \$75

 DOS 3.3
 \$95

To Order:

Continental USA, Hawaii, Alaska:

Call (415) 490-2201

In Canada Call PC Centre, Call (416) 470-0560

International

Call (415) 683-6623

Customer Support & Technical Hotline Call (415) 683-6580

Corporate, University and Government P.O.'s Welcome

All prices are subject to change and quantities may be

OS/2, MS DOS Unix, IBM PS/2, PC, XT, AT, Bitcom, Star Micronix NX-1000, N1.24-10, Epson FX-1050, HP Laser Jet, Logitech Mechanical Mouse, Intel, VCA, EGA are the trademarks or registered trademarks of their respective companies

CLUB V v.1 8/23/88



#### SOFTWARE • BUSINESS

# Good Golly, It's Molly

o you need historical stock market information? Do you not want to bother with the time and expense of tracking it down through an on-line database? Molly can help. Molly is a historical financial database that contains about 100,000 prices—about 3 megabytes of information.

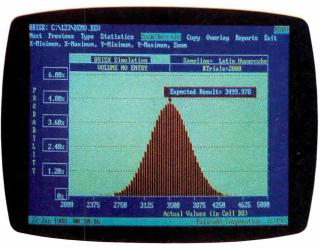
Molly consists of disks with data in Lotus WK1 format for the IBM PC, or Microsoft Excel format for the Macintosh.

It includes the Dow Jones Industrial Average daily close since 1920; the S&P 500 Composite Index daily close since 1928; the S&P price/ earnings ratio and yield on a daily basis since 1940; the Dow Jones transportation and utility averages since 1970; short-term interest rates on a weekly basis since 1970; and intermediate, long-term, and Eurodollar weekly interest rates since 1977. There's also the Nikkei Index, the Value Line Index, the S&P 100 Composite Index, advancing and declining issues on the New York Stock Exchange, and the NYSE advancing and declining volume.

Molly runs on the IBM PC and compatibles with 384K bytes of RAM or on the Macintosh. You'll also need Lotus 1-2-3 for the IBM PC and Excel for the Mac. You can order monthly or quarterly updates for an annual fee. Price: \$199.95; monthly updates, \$79.95; quarterly update, \$49.95.

Contact: MarketBase, Inc., 250 West 90th St., Suite 12K, New York, NY 10024, (800) 627-5385.

Inquiry 764.



@RISK does risk analysis and simulation.

#### @Risk Reduces Risk

uestion: Which program (along with Lotus 1-2-3 and WordPerfect) is required for all incoming students at the Harvard Business School? Answer: @Risk (pronounced "at risk"), a Lotus 1-2-3 add-in designed for risk analysis and simulation modeling.

@Risk is designed for situations where there is uncertainty in the values you enter in your spreadsheet. The program handles uncertainty by letting you enter a range of values. It then uses probability distributions and simulation techniques to evaluate the situation. @Risk uses Monte Carlo-type simulations, where uncertain cell values are varied across the probability distribution. Each simulation calculates hundreds or thousands of what-if scenarios, and then the program tells you the probability of each outcome occurring.

The output from @Risk's calculations is displayed graphically as probability distributions by @RiskGraph's highresolution graphics routines. You can display the output in a variety of formats, including histograms, cumulative curves, summaries over ranges of cells, or overlays. All

graphics outputs are in a standard .PIC format. @Risk supports VGA, EGA, CGA, and Hercules graphics. It comes with a 30-day moneyback guarantee.

Price: \$395.

Contact: Palisade Corp., 2189 Elmira Rd., Newfield, NY 14867, (607) 564-9993. Inquiry 763.

## PackRat Mobilizes Personal Information

polaris calls PackRat a personal information manager and says it's a direct competitor to Lotus' recently shipped Agenda. PackRat is described as a text and graphics database that lets you enter free-form data.

PackRat runs under Microsoft Windows, and the company says Windows' interface and mouse support make PackRat particularly easy to use. For example, you can simply point to a date on a Windows calendar instead of having to type in something like "the day after tomorrow."

PackRat consists of several facilities, including a phone book, phone log, expense log, calendar, agenda, task list, index cards, and disk log file. Each of the facilities has its own local database, but depending on how you

store it, the same information can be displayed on more than one list.

The package also has a tickler function that lets you enter reminders. PackRat can give you a full range of reports that you can select and sort in a variety of ways. The program runs on any system that runs Microsoft Windows.

Price: \$395.

Contact: Polaris Software, 613 West Valley Pkwy., Suite

613 West Valley Pkwy., Suite 323, Escondido, CA 92025, (619) 743-7800. Inquiry 765.

#### TaxCalc Plans Your Taxes

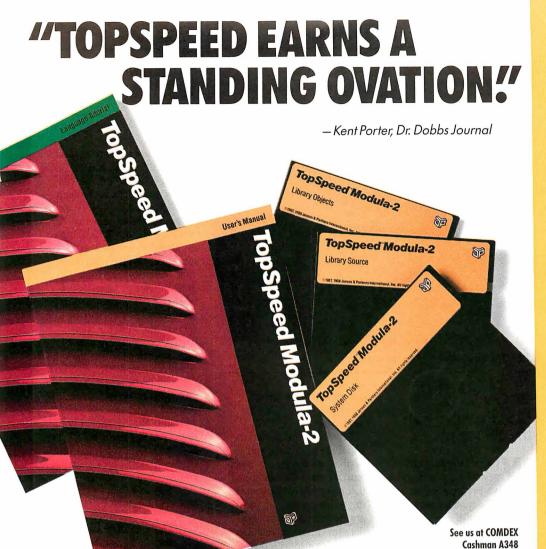
W orried about the implications of tax reform on your personal or business nest egg? TaxCalc can help. TaxCalc Multi-Year Tax Planner is the latest incarnation of the company's popular spreadsheet template. Now it's also available as a standalone run-time version.

The program gives you 3-year tax analysis through 1990, multiple alternative analysis of the same year, the ability to put up to 12 calculations on-screen at one time, and separate schedules for detail input. TaxCalc also calculates a special report that follows IRS Form 8582, which allocates unused passive losses and activities.

The template version of the program works with all popular spreadsheets, including Lotus 1-2-3, SuperCalc, and PC-Excel. It's also available for Excel on the Macintosh. If you have a previous version of TaxCalc, you can update to the new version for \$150. **Price:** \$395.

Contact: TaxCalc Software, Inc., 4210 West Vickery Blvd., Fort Worth, TX 76107, (800) 527-2669; in Texas, (817) 738-3122. Inquiry 767.

continued



"...TopSpeed is surely one of the finest new products introduced to date in the PC arena...DDJ doesn't give unqualified raves very often, but there's no question about it in this case; JPI's TopSpeed Modula-2 is first-rate."

Kent Porter Dr. Dobbs Journal

"JPI Modula-2 looks like another classic in the making. It generates code as good as or better than leading C compilers and the programming environment is a genuine pleasure to use."

Dick Pountain BYTE Magazine

"I liked all of the hard-disk space that was recovered after I deleted my BORLAND, MICROSOFT, and LOGITECH compilers, because with TopSpeed Modula-2 all the rest are obsolete."

> Robert D. Randall Donnelley Marketing

In England and Europe contact:

Road, London ECIM 5NP. Phone: (01)253-4333. Compiler Kit: £59.95, TechKit £34.95, VID £34.95, 3-Pack £109.95.

Handling charges: In UK, add £2 for each product ordered. VAT will be added on software. In Europe, add £4 for up to 3 products, £2 for each add 1 product. The successor of Pascal: JPI TopSpeed™ Modula-2 produces better code than Microsoft C, Turbo C, Logitech Modula-2 and Turbo Pascal 4.0.

Introducing VID: The easy-to-use, source-level debugger. Single-step and trace through source in multiple modules. Examine and modify all variables in symbolic form, including arrays, records, enumerated types and pointers. Point and shoot breakpoints including "One-shot;" "Sticky," "Delayed," and "Monitor." Watch both variables and Modula-2 expressions during execution. Automatic variable trace of all variables accessed, and assembler, registers and procedure call-stack trace windows. Package includes symbolic disassembler and execution profiler. 72-page manual.

**The Compiler Kit includes:** High-speed optimizing compiler (3,000-5,000 lines/min. on a PC AT 8MHz), integrated menu-driven environment with multi-window/multi-file editor, automatic *make*, fast smart linker. All Modula-2 sources to libraries included. BONUS: Complete high-speed window management module included with source. 258-page User's Manual and 190-page Language Tutorial.

**The TechKit\*** includes: Assembler source for start-up code and run-time library, JPI TopSpeed Assembler (30,000 lines/min.), TSR module, communications driver, PROM locator, dynamic overlays, and technical information. 72-page manual.

**System Requirements:** IBM PC or compatible, 384K available RAM, two floppy drives (hard disk recommended).

Circle 130 on Reader Service Card



Seamlessly integrated OS/2 version coming soon.



VID (Visual Interactive Debugger): power without complexity.



Sieve benchmark measured by the British Standards Institution (BSI)— 25 iterations on an 8MHz AT.

Compiler Kit \$99.95 TechKit \$59.95 VID \$59.95

3-Pack \$179.95

(Compiler, TechKit & VID)

To Order: In the US, call:

1-800-543-5202 In Canada, call:

1-800-543-8452

Or mail us your order with a check, money order, or VISA/MC information. 30day unconditional moneyback guarantee.

Shipping & handling charges: In North America: add \$5, plus \$2 for each add'l product. CA residents please add applicable sales tax. Overseas: add \$20, plus \$8 for each add'l product.



Jensen & Partners International

1101 San Antonio Rd. Suite 301 Mountain View, CA 94043 Phone: (415)967-3200

TopSpeed and TechKit are trademarks of Jensen & Partners International. Other brand and product names are trademarks or registered trademarks of their respective holders.

#### SOFTWARE • CONNECTIVITY

#### A Communications **Program** for All Systems

f you have different computers running under different operating systems and want a consistent user interface for communications, a program called Term could be just the ticket. The program runs identically under Unix, Xenix, MS-DOS, VMS, and BTOS. Term's developer, Century Software, claims it is keystroke-for-keystroke-compatible with more than 50 computer systems, ranging from micros to superminis.

Term emulates the VT-100, VT-102, VT-52, Tele-Video 925 and 912, WY-50, ANSI 3.64, and Teletypewriter for every terminal attached to a system. It also has a proprietary file-transfer protocol called TermCRC (Term cyclical redundancy check) that lets you do file transfers at up to 115.2K bits per second. It supports XMODEM, Kermit, Modem7, ASCII, Binary, XON/XOFF, ETX/ACK, and line-by-line protocols.

The program uses Lempel-Ziv Welch data compression, which the company claims results in an average 45 percent to 50 percent speed improvement in file-transfer times. Term automatically converts text-file formats when you're transferring files between different operating systems.

Term includes a full-featured script language that you can use to build full-screen data-entry forms, mail gateways, and completely automated remote communications sessions. It's shipped with 35 prebuilt script applications. Price: Single-user version, \$195; multiuser version, \$350. Contact: Century Software, 5284 South 320 W, Suite C294, Salt Lake City, UT 84107, (801) 268-3088. Inquiry 769.



TERM has a powerful script language.

#### Manage Files with the Bridge

hite Crane Systems' newest version of its Brooklyn Bridge system-tosystem file-transfer package has a number of new features, including a dual-directory display, a file manager, and special DOS utilities. It runs on all MS-DOS-compatible systems and transfers data at up to 115,200 bps.

Using installable device drivers, Brooklyn Bridge 2.0 lets you quickly transfer individual files or groups of files with direct commands. But like its competitors—such as LapLink—the new version also has a dual-directory display that lets you see the directories of both machines at once. You use the dual directory along with a 1-2-3-like menu to choose your transfer options.

The new version also has several DOS utilities, such as BACKUP, that copy only files that have been created or changed since the last time you used Brooklyn Bridge. There's also MOVE, which deletes the original file once it's transferred; COPY, which lets you work with multiple files using a single command; and REMOVE, which has a security option that ensures that deleted files are unrecoverable.

Brooklyn Bridge 2.0 lets you share hard disks and peripherals between two systems. It has a RUN command that gives you multiprocessing by letting you run programs on a slave system at the same time you're doing something else with the master. The program comes with both 31/2-inch and 51/4-inch disks, along with an 8-foot universal serial cable. A 50foot cable is also available. Price: \$139.95; upgrade from previous version, \$35. Contact: White Crane Systems, Inc., 6889 Peachtree Industrial Blvd., Suite 151, Norcross, GA 30092, (404) 394-3119

Inquiry 772.

#### NetWare Lands the Mac

long with MS-DOS and OS/2, Novell's NetWare local area network (LAN) software now supports the Apple Macintosh. If you're using your Mac in an Apple-Share network, NetWare's newest version lets you be fully compatible. Because each system continues to use its native operating system, Macintosh, IBM PC, and PS/2 users can continue to see and use

the environment they're most comfortable with, while sharing files and data across the network without the need for conversion.

Designed for use with NetWare version 2.15 or higher, NetWare for the Macintosh gives you the fault tolerance, security, and high performance of Novell's network and lets you use a lower-cost IBM-compatible file server. Macs use the standard AppleShare client software to access the NetWare file server. NetWare provides full support of AppleTalk protocols within the server. Price: \$200. Contact: Novell, Inc., 122

East 1700 S, Provo, UT 84601, (800) 526-5463; in Utah, (801) 379-5900. Inquiry 770.

#### Carbon Copy Now **Handles Graphics**

arbon Copy Plus, a remote-control communications package for the IBM PC and compatibles, is now available in version 5.0. This newest version adds background file transfer and a universal graphics translator.

The background file-transfer feature lets you transmit a file to another Carbon Copyequipped computer without interrupting the application you're working on. With the universal graphics translator, the program supports EGA, VGA, Hercules, CGA, and extended CGA cards. All of these are interchangeable, which lets you and the Carbon Copy user on the other end see and interact with the same graphical screen image. Price: \$195; upgrade from previous version, \$50. Contact: Meridian Technology, Inc., 1140 Hammond Dr., Suite A-1125, Atlanta, GA 30328, (404) 390-9152. Inquiry 771.

continued



#### SOFTWARE • OTHER

#### Microsoft Takes You for a Ride

our years in the making, Microsoft's long-awaited update to its popular Flight Simulator is ready for takeoff. Version 3.0 has many new features, including the ability to run on high-speed AT clones and support full 640- by 350-pixel, 16-color EGA and VGA displays.

Besides the old familiar Cessna 182 and Sopwith Camel, you can now add more than a little spice to the experience with a Gates Lear Jet and a Crop Duster. Flight Simulator 3.0 now uses pull-down windows to control navigation and communications, flight analysis, environmental conditions, and flight scenarios.

There's also a new learning mode that gives you basic and advanced flight training, aerobatics, and navigation instruction. These are prerecorded flight sessions designed for pilots from beginner's rank all the way to advanced. A flight analysis package tells you how well you've done.

If you're the adventurous sort, you can try a night landing on an aircraft carrier, the ultimate test of flying skill. You can also fly together with other Flight Simulator 3.0 users through a null modem cable or through telephone lines.

Flight Simulator 3.0 runs on the IBM PC, XT, AT, PS/2s, and 100 percent compatibles. You'll need at least 256K bytes of RAM, DOS 2.0 or higher, and a CGA, EGA, VGA, or Hercules adapter.

Price: \$49.95.
Contact: Microsoft Corp., 16011 Northeast 36th Way, P.O. Box 97017, Redmond, WA 98073, (206) 882-8080.
Inquiry 775.



Flight Simulator 3.0 steps closer to reality.

## Forge a Few Fantastic Fonts

Version 1.1 of Z-Soft's Publisher's Type Foundry includes numerous new features that make electronic publishing packages faster and easier to use. The package, which runs under Microsoft Windows, lets you design and modify type fonts for laser printers.

The biggest new feature is

a Windows screen font translator. This lets you see the final version of the font you've designed on-screen, as well as use it in other applications. Other new features include a virtual memory manager for handling large and complex images without performance degradation; data compression; and an editor that lets you set character height and width guidelines. This makes it easier to create uniformlooking fonts.

Version 1.1 now includes

full support for the Hewlett-Packard LaserJet II, including both portrait and landscape modes. A DOS utility is included that lets you download your fonts to HP printers without having to use Windows.

Finally, the new version of Publisher's Type Foundry includes several new bit-map and outline fonts. Best of all, if you're a registered owner of the current version, you can get the new version gratis.

Price: \$495.

Contact: Z-Soft Corp., 450 Franklin Rd., Suite 100, Marietta, GA 30067, (404) 428-0008.

Inquiry 776.

# On Cue Fights Window Buildup

f you're one of those Macintosh users who keeps switching from application to application, having to return to the Finder (or MultiFinder) every time can be a pain. It can also result in "window build-up" of numerous stacked windows on your Mac desktop. A new program called On Cue claims to solve all these problems.

On Cue gives you a pulldown menu that shows your most frequently used applications. You can move among them simply by clicking on the application you want to use. You won't have to move between overlapping windows on the desktop or wait for folders to open and close.

The program works with all Macs from the 512KE on up. It's easy to configure to your specific needs, and installation is a simple matter of dragging On Cue's icon to your system folder.

Price: \$59.95. Contact: ICOM Simulations, Inc., 648 South Wheeling Rd., Wheeling, IL 60090, (312) 520-4440. Inquiry 777.

#### Describe Files with Words

ver run into situations where those eight-character-plus-extension DOS filenames become incomprehensible gibberish in a few weeks? Would you remember what you meant by SAPM4755.TXT or APP-2REV.WK1? Extend-A-Name can help. It lets you use filenames or descriptions that are up to 60 characters long.

Extend-A-Name is RAMresident and uses from 39K bytes to 65K bytes of memory. If you have LIM version 4.0 expanded memory, the program takes only 3K bytes in your base RAM. The program continually scans the screen for your application program's load prompt. It then pops up with a library screen where you can choose a previously created file or make a new one.

The program lets you create libraries, which are logical divisions of subdirectories. They let you further organize your files. Extend-A-Name also has a number of additional features, including copy, delete, assign, rename, tag, and untag. You can perform all these functions without having to leave your application.

Price: \$79.95.

Contact: World Software Corp., 124 Prospect St., Ridgewood, NJ 07450, (800) 962-6360; in New Jersey, (201) 444-3228. Inquiry 778.

BYTE · OCTOBER 1988



REWARD THE COMPUTER ENTHUSIASTS ON YOUR GIFT LIST WITH A YEAR'S SUBSCRIPTION TO BYTE — THE DEFINITIVE GUIDE TO PERSONAL COMPUTING.

EACH GIFT WILL INCLUDE 12 ISSUES, PLUS A BONUS ISSUE DEDICATED TO IBM PC'S. YOUR FIRST GIFT WILL COST ONLY \$22.95 WITH ADDITIONAL GIFTS COSTING EVEN LESS; ONLY \$19.95 EACH — BOTH GREAT MONEY SAVING RATES WHEN YOU CONSIDER THAT ONE YEAR OF BYTE PURCHASED AT THE NEWSSTAND WOULD COST \$42! (CANADA: FIRST GIFT \$25.95, ADDITIONAL GIFTS \$22.95 EACH.)

DON'T GET CAUGHT IN THE HOLIDAY RUSH, SEND US YOUR GIFT LIST TODAY AND WE'LL DO THE REST.

YES! I want to send gift subscriptions to the following people and save money off the newsstand price!	TO: (1st Gift-\$22.95; Canada \$25.95)  Name  Address
FROM:	City/State/Zip
Name	(Each additional gift-\$19.95; Canada \$22.95 each
Address	Name
City/State/Zip	Address
<ul> <li>□ Payment enclosed* □ Bill me</li> <li>□ Charge to: □ VISA □ MasterCard</li> </ul>	City/State/Zip
Acct. # Exp. date	Name
Signature	Address
*Please send this order card with payment in an envelope to: P.O. Box 550, Hightstown, NI 08520-9893	City/State/Zip
-	Name
FREE BONUS — A gift announcement will be sent in your name to the recipient.	Address

City/State/Zip

Please allow 6-8 weeks for processing.



REWARD THE COMPUTER ENTHUSIASTS ON YOUR GIFT LIST WITH A YEAR'S SUBSCRIPTION TO BYTE — THE DEFINITIVE GUIDE TO PERSONAL COMPUTING.

EACH GIFT WILL INCLUDE 12 ISSUES, PLUS A BONUS ISSUE DEDICATED TO IBM PC'S. YOUR FIRST GIFT WILL COST ONLY \$22.95 WITH ADDITIONAL GIFTS COSTING EVEN LESS; ONLY \$19.95 EACH — BOTH GREAT MONEY SAVING RATES WHEN YOU CONSIDER THAT ONE YEAR OF BYTE PURCHASED AT THE NEWSSTAND WOULD COST \$42! (CANADA: FIRST GIFT \$25.95, ADDITIONAL GIFTS \$22.95 EACH.)

DON'T GET CAUGHT IN THE HOLIDAY RUSH, SEND US YOUR GIFT LIST TODAY AND WE'LL DO THE REST.

# BUSINESS REPLY MAIL

FIRST CLASS MAIL PERMIT NO. 42 HIGHTSTOWN, NJ

POSTAGE WILL BE PAID BY ADDRESSEE



Computers and Communications Information Group P.O. Box 550 Hightstown, NJ 08520-9893 NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

# Com-Tek Data Systems, Inc.

#### MODEL IO 80286-THE WISE CHOICE

POWERFUL Performance at a practical price is what you will get with COM-TEK's SUPER TURBO A/T.

#### BACK TO SCHOOL SPECIAL MODEL IQ-8088 SYSTEM

10 mhz Mother Board-256K Ram 10 mnz Mother Board—256K (2) 360K Floppy Drives Mono Monitor—84 Keyboard Multi-I/O—Phoenix Bios Parallel, Serial, Game Ports

\$70000

POWERFUL Performance at a practical price is what you will get with COM-TEK's SUPER TURBO X/T.

Configured to your specifications at a very reasonable price, our X/T is built to suit your every need.



The Personal Computer that will run away with you. Home or Office.

Complete System Includes

- LS-A804 All in One Multi Main Board Selectable CPU speed of 4.77/10 Mhz Complete W/Multi I/O + MCGP-Mono+Graphics Card RS-232 Serial adapter, Parallel printer adapter Game Port adapter/360 Kbyte Floppy adapter Microsoft Bus versionmouse adapter Real Time Clock/Calendar CPU 8088-1/512 Memory Expandable to 640KB Award or Phoenix Bios Included Keyboard Lock, Power LED/Turbo Mode LED
- \* 150 watt power supply/ X/T Slide case
- 20 Meg Seagate Hard Disk/ 360K Floppy Disk
- Keyboard 84 Key/ Packard Bell 12" Monochrome Monitor
- Printers Optional\*\*
- \*\*\* FREE Word Processing Software...

#### HARDWARE PRICES

HANDWARE PRICES
20 Meg with Controller Card         .\$275.00           40 Meg with Controller Card         .\$425.00           80 Meg with Controller Card         .\$775.00
380K Floppy Drive         \$ 80.00           1.2 Floppy Drive         \$115.00           3.5 Floppy Drive         \$120.00           1.44 Floppy Drive         \$130.00
Mono Card         \$ 49.0           EGA Mono Card         \$142.0           CGA Color Card         \$ 48.0           EGA Color Card         \$112.0           VQA Color Card         CALL
Taxan 770 Multi Sync Monitor         \$840.0           Peckard Bell Mono Monitor         \$85.0           Im-Tec Color Monitor         \$245.0           Casper Mono Monitor         \$80.0           Relisps EGA Monitor         \$435.0           NEC Multi Sync II VGA         \$640.0           Taxan EGA Monitor         \$475.0
AT Controller Card \$142.0  XT Controller Card \$124.0  XT Controller Card \$124.0  XT Multi I/O Card \$18.0  XT Multi I/O Card \$58.0
XT Pre-built 3 in 1 Motherboard \$2350 XT Pre-built Motherboard \$1850 AT 80286 Pre-built Motherboard \$4850 AT 80388 Pre-built Motherboard \$18950 AT 80288 Bay Pre-built Mills \$4950
84 Keyboard
8088-10 MHZ 3 in 1 Motherboard         \$145.0           8088-10 MHZ Motherboard         \$120.0           8028-12 MHZ Motherboard         \$342.0           8028-12 S MHZ Motherboard         \$342.0           80286 Baby 12 S MHZ Motherboard         \$334.0           8038-16 MHZ Motherboard with 1 Meg         \$1625.5
XTMT Slide Case \$ 34.6 AT Baby Case \$ 55.6 AT Slide Case \$ 65.6 AT Tower Case \$ 285.6 AT Tower Case \$ 285.6 AT Tower Case \$ 285.6
150 Watt Power Supply       \$ 48.0         200 Watt Power Supply       \$ 68.0
40 Meg Tape Backup System     \$349.0       MS-DO3 33 GWBASIC     \$120.1       1200 Modem     \$950.2       2400 Modem     \$235.6
Printers*CALL



#### SPECIFICATIONS MOTHERBOARD:

POWER: DISKS:

CABINET:

KEYROARD:

DISPLAY SET:

WARRANTY:

#### STANDARD A/T MODEL IQ-80286

Intel 80286 microprocessor key selectable normal (8.0 mhz) and turbo (12.5 mhz) processing speeds, socketed for the 80287 math coprocessor, eight expansion slots (2 eight bit—6 sixteen bit), clockcal, 1 meg. RAM included. Multi I/O and Phoenix or Award Bios included.

200 watt, switching power supply with leads for 4 devices.

(1) 1.2 meg, half height, dual sided—quad density floppy drive. (1) 40 megabyte, half height, fixed disk drive. 40MS access time.

Full size AT style drawer cabinet with corporate security lock panel mounted reset switch, and status LEDs for turbo, power and fixed disk.

Enhanced style, 101 keys with LEDs to indicate NUM locks and CAPS lock status, separate cursor pad, numeric touch pad, top mounted function keys. Hi-res, text and graphics, monochrome card (Herc. compat.) hi-res, TTL amber monochrome monitor. 1 parallel port.

1 year on parts and labor limited depot warranty. 30 day money back guarantee if not satisfied with out product, for any reason.

price, our A/T is built to suit your every need.

tions at a very reasonable

Configured to your specifica-

#### YOUR PRICE

#### \$1695.00

POWERFUL Performance at a practical price is what you will get with COM-TEK's SUPER TURBO A/T. Configured to your specifications at a very reasonable price, our A/T is built to suit your every need.

MODEL IQ 80286-THE WISE CHOICE

\*OPTIONS AVAILABLE

# 中国世

#### SPECIFICATIONS

POWER:

Intel 80386 microprocessor, user selectable (4.77, 8.0 and 16.0 mhz) upgradeable to 20 mhz. Processing speeds, socketed for the 80287 math coprocessor, eight expansion solts (2 eight bit, 5 sixteen bit, and 1 thirty-two bit), clock-cat, 2 mag. RAM included, upgradeable to 8 mag. Includes Phoenix or Award Bios and Multi-I/O card.

STANDARD A/T MODEL IQ-80386

200 watt, switching power supply with leads for 4 devices (1) 1.2 meg, half height, dual sided—quad density floppy drive and 1.44 floppy.
(1) 80 megabyte, full height, fixed disk drive. Seagate.

Full size AT style drawer cabinet with corporate security lock panel mounted reset switch, and status LEDs for turbo power and fixed disk. CABINET:

Enhanced style, 101 keys with LEDs to indicate NUM lock and CAPS lock status, separate cursor pad, numeric touch pad, top mounted function keys. KEYBOARD

Hi-res, text and graphics, monochrome card (Herc. compat.) hi-res, TTL amber monocrhome monitor, 1 parallel port.

year on parts and labor limited depot warranty. 30 day money back guarantee if not satisfied with our product for any reason.

Award Bios Multi I/O

#### OPTIONS AVAILABLE

Color system (CGA)
EGA system
Wath co-pro A/T
Additional 1.2 dr.
360K floppy dr.
1.44 floppy

DISPLAY UNIT

WARRANTY:

20 meg drive 40 meg drive 80 meg drive 3.5 floppy driv MS-DOS 3.21

1200 modem 2400 modem Additional RAM \* Available in the tower case. Call and ask for specifications.

what you will get with COM-TEK's SUPER TURBO IQ 80386. Configured to your specifications at a very reasonable price, our IQ 80386 is built to suit your every need. MODEL IQ 80386-THE SUPER WISE CHOICE!

POWERFUL Performance at a practical price is

- · COM-TEK HAS DESIGNED THEIR POLICY TO BETTER SERVE, HELP AND PROTECT THEIR CUSTOMERS.
- COM-TEK MAKES SURE ALL THEIR CUSTOMERS GET 1st PRIORITY IN SALES-SERVICE-CUSTOMER RELATIONS
- COM-TEK'S FRIENDLY STAFF IS BETTER TRAINED TO HELP AND SUPPORT YOU IN EVERY WAY POSSIBLE WITHOUT I FAVING YOU ON HOLD.

30 DAY MONEY BACK GUARANTEE FOR ANY REASON—NO QUESTIONS ASKED—1 YEAR ON PARTS AND LABOR—LIMITED DEPOT WARRANTY

#### SYSTEMS • SYSTEM OPTIONS • NETWORKING CALL FOR SPECIFICATIONS

In N.H.: 603-363-8333

1-800-942-4255 Outside of N.H.

P.O. Box 221

Corner of 9 & 63, Chesterfield, N.H. 03443

Tech Support Call: 603-363-8334

## WHAT'S NEW

#### METRO NEW YORK • NEW ENGLAND

#### Sales Prospect Management

rosell is a program designed for sales executives who often work on the road. It includes a calendar and account management and file capabilities, which are cross-linked to provide automatic updates among sections. The program also includes a calculator, phone directory, and import/export utilities.

Prosell's prospect management system consists of a prospect worksheet with firm addresses, contacts, phone numbers, next step and target date, automatic update, retrieval of prospects from multiple fields, and more. With the prospect summary report, you can sort by time or by number of dollars ranking and send the report to the printer or to management by electronic mail.

The file cabinet includes eight documents: letter, memo, quotation, order, expense report, travel log, formletter library, and scratch pad. You can retrieve the documents by four categories: date, document number, subject, and prospect name.

You can also use Prosell to make visual presentations on your laptop, and you can store up to 15 different presentations in your computer.

Prosell runs on the IBM

#### Send Us Your Local News

YTE is expanding its coverage of local events in the Northeast region. If you would like your event, seminars, conferences, or local computer users group covered, please send information to: Regional Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.



You can organize your sales prospects with Prosell.

PC, XT, AT, PS/2s, and compatibles with 640K bytes of RAM and DOS 3.0 or higher. The manufacturer recommends at least 10 megabytes of hard disk space.

Price: \$795.

Contact: Lowell Corp., P.O. Box 15053, Worcester, MA 01615, (508) 756-5103. Inquiry 815.

# Multimedia Database for CD-ROM Publishers

ediaBase is a DBMS that lets you store and combine text, bit-mapped graphics, and audio and video images for publication and distribution on CD-ROM. With an optional publishing utility, you can output a nine-track tape in High Sierra format and send it directly to a CD-ROM stamping facility.

You can link analog video images from a laserdisk player to records in your database, and when you query those records, the video will play automatically on a television screen. You can also play and control from the database one or two of the soundtracks on a laserdisk.

You can perform Boolean, phrase, proximity, wild-card, and, naturally, word searches in the database.

MediaBase runs on the

IBM PC, XT, AT, 80386-based machines, and compatibles with 640K bytes of RAM, a hard disk drive, and DOS 3.0 (DOS 3.2 if a CD-ROM drive is attached) or higher. It is compatible with EGA, CGA, and Hercules cards and Microsoft-compatible mice.

Price: \$750; CD-ROM publishing utility, \$5000. Contact: Crowninshield Software, Inc., 1105 Commonwealth Ave., Boston, MA 02134, (617) 787-8830. Inquiry 814.

# Classes for Building MIDI Software

Two musicians/programmers are offering a series of six weekly classes on MIDI programming. The classes start on October 3 and will cover the topics of the MIDI specification; an overview of librarians, editors, mappers, sequencers, and compositional programs; converting data; building a sequencer; and more.

The classes will be taught by Joe Ravo, a professional musician who's written commercial MIDI programs, and Charlie Miller, a professional musician who's also the president of MUSIG, the New York City's MIDI user group. The classes aren't language-specific, and you needn't bring any hardware or software.

Price: \$250 for the series. Contact: Charlie Miller, 362 West 52nd St., New York, NY 10019, (212) 246-7438.

#### Two Shows, One Roof

he Jacob K. Javits Convention Center in New York City will be swarming with engineers, technicians, and information specialists the second week of October as it hosts the Fall Design Engineering Conference and Info '88, the Information Management Exposition.

The engineering conference is sponsored by the American Society of Mechanical Engineers and will run from October 11 to 13. It will feature exhibits of CAD/CAM/CAE applications, laboratory and production test equipment, and other engineering topics. The conference expects to

draw 6000 attendees and 275 exhibitors.

Info '88, which will run from October 11 to 14, is dedicated to MIS executives and Fortune 1000 end users. Exhibitors will display software, peripherals and accessories, local-area networks, communications systems, and computer security devices. The show expects to draw 400 exhibitors and 45,000 attendees. The convention center is located at West 36th St. and 11th Ave., New York, NY. Contact: Cahners Exposition Group, Stamford Office, 999 Summer St., P.O. Box 3833, Stamford, CT

06905, (203) 964-0000.

# If you're still not sharing your laser printer, oink, oink!

Booth #B-106

A laser printer is expensive. That's why it makes sense to share it among more than one PC.

SmartPrint lets you do just that. It connects up to six PCs of any kind to any laser printer.

Then, all six PCs can use the same printer. SmartPrint scans and "locks on" to the right PC automatically. No switches or A/B boxes are needed.

A lit display lamp indicates which PC is currently "connected."



After printing SmartPrint "locks on" to the next PC sending printer data.

SmartPrint requires no software either, so it's completely transparent to the user and compatible with virtually every application or environment-even LAN systems.

And your laser printer can be located as far as 1,000 feet from your PCs because SmartPrint has its own line driver and power supply.

It's easy to use, too. You can install SmartPrint yourself in

a few minutes using standard serial cables.

#### The Price/Performance Winner

SmartPrint costs only \$149, which makes it the best buy in its class.

Guaranteed!

If you're not completely satisfied return SmartPrint within 30 days for a full refund.

SmartPrint is made in the USA with quality electronic components and a rugged metal casing. And it's backed with our full oneyear repair/replacement warranty.

So call now and use your Visa, MasterCard, or AmerEx. And stop hogging your laser printer!

Only

1-800-368-7737 (Anywhere in the United States or Canada)

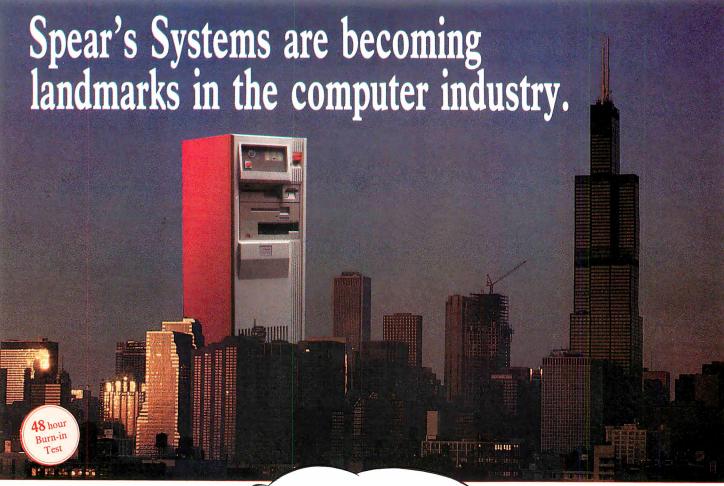


Dresselhaus 8560 Vineyard Ave., Suite 405, Rancho Cucamonga, CA 91730/(714) 945-5600









#### SPEAR'S 386/20

- Elegant Tower Case
- 80386/20MHz, SI = 24
- Fully compatible with IBM AT®
- \_\_ 1.2M High Capacity floppy drive
- 3 1/2" 1.44M floppy, drive of the future
- \_\_ 71MB Hard Disk

#### MONO-286/8

\$995

**\$CALL** 

- ▲ 80286 CPU 8/6 MHz
- Hercules Compatible Mono card
- Monochrome monitor

#### EGA-286/8

\$1620

- 80286 CPU 8/6 MHz
- EGA monitor and EGA card
- 20MB HH Hard Disk

#### PRO-286/10

\$2150

- 80286 CPU 10 MHz/1WS
- \_\_ EGA card
- \_\_ Diamond Scan monitor
- AT 30 MB Hard Disk

#### MONO-286/12

\$1499

- 80286 CPU 12 MHz/0WS
- Small footprint to save space
- Mono card
- Monochrome monitor
- \* All systems come with 1.2MB floppy drive, and FD/HD dual controller.

#### **SUPER-286/12**

- \_\_\_ 80286 CPU 12 MHz/0WS
- Small footprint
- EGA card and Diamond Scan monitor
- 1.44M 3 1/2" floppy drive
- \_\_\_ 40MB HH Hard Disk

#### EGA-286/12

- 80286 CPU 12 MHz/0WS
- Small footprint
- EGA monitor and EGA card
- 20MB HH Hard Disk

#### **MONO-386**

\$2050

\$2540

\$3295

- \_\_\_ 80386-16 CPU
- 16/6 MHz/0WS Wait State
- 64K SRAM Cache
- Mono monitor and card

#### EGA-386

► 80386-16 CPU

- EGA monitor and EGA card
- 20MB HH Hard Disk

#### SERVER-386

80386-16 CPU

- EGA cardDiamond Scan monitor
- 71 MB Hard Disk

#### \$2490



\$2151

#### Everex Modems

1200B Internal 2400B Internal 2400B External

OTHER PRODUCTS:

#### Everex Tape Backup

40MB External
60MB Internal
125MB Internal
40MB Floppy Tape

#### Hard Disk

20MB (XT) \$26 40MB (HH) \$58 71MB \$86

#### XT MONO System (10MHz) \$599

## BRAND NAME LAPTOP (640K, 2Drives) \$1259

Graphic cards, EMS cards,

monitors, printers, 3 1/2" floppy drives, etc.

CALL

Call Spear Technology (312) 480-7300



TECHNOLOGY INC

710A Landwehr, Northbrook, IL 60062 Sales: (312) 480-7300 Tech Support (312) 480-7386 FAX: (312) 480-9538

Spear 03 V1.2 7/20/88

Attractive Discount for Dealers and Quantity Buyers.

Special Discounts for Students and Professors (ID required).

30 day Money back Guarantee

Everex, Hercules, IBM, AT, Diamond Scan, and OS/2 are trademarks and registered trademarks of their respective companies. Spear Technology, Inc. provides you with excellent quality and services. If you are not satisfied for any reason please call our president, Webster or V. P. Ahmed at (312) 480-7300. If you have any technical questions, our full-time technical support staff is there to answer them.

Terms: We accept MasterCard, Visa, COD (Cashier check, cash, or approved check), Company/Institutional P.O.. For returns and repairs, call for RMA number. A 15% restocking on all unauthorized returns item. No credit issued after 30 days from date of shipment. Copies of original sales order must accompany any return. Prices are subject to change.



# INDEPENDENT STORE IN NYC DEDICATED TO IBM © PC SOFTWARE AND PERIPHERALS ONLY

If We Don't Have It, It's Probably Not Worth Having. STORE HOURS: 9:00 A.M.-5:30 P.M. E.S.T. MON.-FRI. SATURDAYS: 10:00 A.M.-4:00 P.M.

Terms, Conditions and Prices May Differ In Our Store.

CORPORATE ACCOUNTS WELCOMED.

PC LINK, CORP. 29 WEST 38TH STREET. 2ND FL., NEW YORK, NY 10018

CALL TOLL FREE 1-800-221-0343

All prices listed in this ad are effective Oct. 1-31, 1988. All Brands are Registered Trademarks. IBM is a Registered Trademark of IBM Corp.

IN NEW YORK CALL 1-212-730-8036

#### THIS MONTH'S SPECIALS—OCTOBER 1st through 31st

	I HIS MUI	NIH SSPECIALS-OCTOBER ISLUITOL	
IMAGEN. PC PUBLISHER KIT1595.00	LOGITECH. HIREZ MOUS	BE (Bus Version) 85.00 FONTWARE Soft Fonts	MICROSOFT.  MOUSE Serial or Bus Version 99.00
BUSINESS SOFTWARE	ı	BRIGHTBILL-ROBERTS	DISKDRIVES
ASHTON-TATE	CALL	SHOW PARTNER	I OMEGA. 20MB BETA II INT. DRIVE 959.00 MINISCRIBE. 70MB HARD DISK FOR AT 859.00
dBASE III PLUS 1.1 MULTIMATE ADVANTAGE II	CALL	SHOW PARTNER F/X	MINISCRIRE 40MB HARD DISK FOR AL., 629.00
BORLAND INT.		LOTUS DEV. FREE LANCE+(Sold In Store) 359.00	SEAGATE. ST-225 20MB WITH W/D 309.00
EUREKAANSA PARADOX V 2.0	. 99.00	MICROGRAFX, WINDOWS DRAW	SEAGATE. ST-225 20MB WITH WID         309.00           SEAGATE. ST-251-1 40MB FOR AT         595.00           SYSGEN. QIC FILE 60 EXT.BACKUP         859.00
ANSA PARADOX V 2.0	439.00	SOFTWARE PUBLISHING	SYSGEN.QIC FILE 60 EXT.BACKUP 859.00
PROLOG 1.1SIDEKICK PLUS	69.00	HARVARD PRESENTATION GRAPHICS 295.00 XEROX. VENTURA (NEW) VERSION 2.0 CALL	SYSGEN. BRIDGE FILE         349.00           SYSGEN. BRIDGE TAPE         549.00           TOSHIBA. 3 1/2" & 5 1/4' Drives         CALL
TURBO BASIC	69.00	7 SOFT PC PAINTERIISH + 99.00	TOSHIBA. 3 1/2" & 5 1/4' Drives CALL
TURBO C	69.00	Z SOFT. PUBLISHER PAINTBRUSH	ACT ACT THE PROPERTY OF A PARTITION OF
TURBO PASCAL 4.0QUATTRO	79.00		EXPANSION BOARDS
QUATTRO	. 139.00	UTILITIES CORE INT. CORE EAST 119.00	64K 150NS RAM CHIPS CALL 256K 150NS RAM CHIPS CALL
CLEAR SOFT. CLEAR (CHART dBASE COI CONCENTRIC DATA	UE) CALL	CORE INT. CORE FAST	AST. SIXPAK PREMIUM 0KB C/S/P 209.00
R & R REPORT WRITER FOR DRASE III	l+ 129.00	FIFTH GENERATION. FAST BACK+ 129.00	DCA IRMA BOARD II 799 00
R & R REPORT WRITER FOR DBASE III CROSSTALK COMMUNICATIONS		FUNK SOFT, SIDEWAYS 3.2 59.00	I HERCHIES MONO GRAPHICS PLUS 199.00
CROSSTALK MK.4	. 129.00	MICROLYTICS. GOFER	I INTEL. ABOVE BOARD PS/286 512K 489.00
CROSSTALK XVI 3.6	85.00 109.00	MICROSOFT. LEARNING DOS	<b>TALL TREE.</b> JRAM-3 0K (TO 2MB)
FOXSOFTWARE		NORTON LITILITIES ADVANCED 4.0 99.00	VIDEO 7. VEGA VGA
FOX BASE PLUS V 2.1FOX BASE+ MULTIUSER	229.00	REVOLUTION. CRUISE CONTROL 29.00 QUALITAS. 386 TO MAX	VIDEO 7. FAST WRITE VGA 8 or 16 Bit 499.00
FOX BASE+ MULTIUSER	379.00	QUALITAS. 386 TO MAX	VIDEO 7. V-RAM VGA 8 or 16 Bit 599.00
GREAT PLAINS. ACCOUNTING PACKAG	GES CALL	SOFT CRAFT. FANCY FONT         149.00           SOFT CRAFT. LASER FONT         149.00	NETWORKING
JAVELIN SOFT. JAVELIN KORTEK. FREEWAY ADVANCED	/5.00	SOFT CRAFT. LASER FONT 149.00 TRAVELING SOFT. LAP-LINK 89.00	NETWORKING INVISIBLE. NETWORK 200 299.00
LIFETREE SOFT. VOLKSWRITER 3	129.00	03.00	SERVERTECHNOLOGY
LOTUS DEV. CORP.		GRAPHICTABLETS, KEYBOARDS, MICE	FASYLAN STARTER KIT FOR 2 PC'S 179.00
LOTUS 1-2-3(SOLD IN OUR STORE) SYMPHONY (SOLD IN OUR STORE)	329.00	DATA DESK. TURBO KEYBOARD 139.00	EASYLAN EXPANSION KIT FOR 1 PC'S 99.00
SYMPHONY (SOLD IN OUR STORE)	479.00	LOGITECH. HiREZ MOUSE (Bus Version) . 85.00	SCANNERS & FACSIMILE
AGENDA (SOLD IN OUR STORE)	139.00	LOGITECH. C7 MOUSE+PC PAINTBRUSH 99.00 LOGITECH. C7 PUBLISHERS MOUSE 119.00	BROTHER. PERSONAL FAX-100 975.00
MERIDIAN. CARBON COPY PLUS	139.00	MICROSOFT. SERIAL OR BUS MOUSE 99.00	DEST. PC SCANNERS CALL
MICRO PRO	11,1000,1100,000	MICROSOFT. SERIAL OR BUS MOUSE 99.00 MICROSOFT. MOUSE WITH WINDOWS 145.00	
WORDSTAR 2000+ REL.3	249.00	PRINTERS	COMPUTERS
WORDSTAR 2000+ REL.3 LEGAL VERSIC	ON CALL	BROTHER. M-1709 240 CPS PAR/SER CALL	PC LINK  3864 MODULET 16MHZ 1MB 32 BIT RAM.
WORDSTAR PROFESSIONAL REL.5 MICROSOFT		HEWLETT-PACKARD.LASERJET II CALL HEWLETT-PACKARD.DESKJET	386A MODULE1. 16MHZ, 1MB 32 BIT RAM, ONE 1.2MB DRIVE
CHART V 3.0	295.00	OUTPUT TECH, OT-850XL 850 CPS CALL	386A MODULE11. 16MHZ, 1MB 32 BIT RAM,
C COMPILER	309.00	I TOSHIBA. P351SX 1095.00	ONE 1.2MB DRIVE, 40MB HARD DISK 2695.00
C COMPILER FORTRAN COMPILER MACRO ASSEMBLER	309.00	TOSHIBA. P321SL 495.00	386A is a X i type chassis, can accommodate A i
MACHO ASSEMBLER	119.00	HP LASER ACCESSORIES	size adapters. 386B MODULE1. 16MHZ, 1MB 32 BIT RAM,
PROJECT	309.00	BITSTREAM. FONTWARE (SOFT FONTS) . 149.00 HEWLETT-PACKARD	ONE 1.2MB DRIVE 2295.00
QUICK BASIC	69.00	FONT CARTRIDGES	386B MODULE11, 16MHZ, 1MB 32 BIT RAM.
I QUICK C	69.00	(A.C.D.E.G.H.)ea. 129.00	ONE 1.2MB DRIVE, 40MB HARD DISK 2795.00 386-20 MODULE1. 20MHZ, 1MB 32 BIT RAM,
WINDOWS	69.00	(B,F,J,K,L,M,N,P,Q,T,U,V,W,X,Y)ea. 219.00	386-20 MODULE1. 20MHZ, 1MB 32 BIT RAM, ONE 1.2MB DRIVE
WINDOWS	145.00	(R,Z)ea. 295.00 SOFT FONTSea. 169.00	ONE 1.2MB DRIVE 2495.00 386-20 MODULE11. 20MHZ, 1MB 32 BIT RAM,
WORKS	209.00	SOFT FONTSea. 169.00  MEMORY FOR LASERJET II ONLY	ONE 1.2MB DRIVE, 40MB HARD DISK 2995.00
MONOGRAM. DOLLARS & SENSE	109.00	1MB/2MB/4MB MEMORY BOARDS CALL	386B & 386-20 are a AT type chassis.
NANTUCKET. CLIPPER	399.00	IQ ENGINEERING. SUPER CARTRIDGE 599.00	STANDARD FEATURES FOR PC LINK 386.
OWL INT. GUIDE 2.0	159.00	IMAGEN. PC Publisher Kit adds DDL, HP-GL &	CHASSIS CAN ACCOMMODATE UPTO FIVE
QUARTERDECK. DESQ VIEWSBT. ACCOUNTING SOFTWARE (Sold in Stor	89.00 re) CALL	15 HP Cartridges HP 7470/7475 per plotters	1/2 HEIGHT DEVISES (3 are accessible), HARD/FLOPPY CONTROLLER WITH CABLES,
SSC. SOFTWARE BRIDGE	129.00	Diablo 630, Epson MX-80/FX-80. & more.	I 101 ENHANCED KEYROARD SERIAI /PARALLEI
STSC		PostScript to HP Laserjet printers. Emulates 15 HP Cartridges, HP 7470/7475 pen plotters. Diablo 630, Epson MX-80/FX-80, & more. Comes with 30 (1 to 254 point) Fonts, 2Mb Ram PC Publisher Kit for HP Laserjet II	PORTS, BATTERY BACK REAL TIME CLOCK,
APL*PLUS V 7.0	649.00	PC Publisher Kit for HP Laserjet II 1595.00	ONE YEAR WARRANTY.
STATGRAPHICS	649.00	MONITORS	TOSHIBA
PROTEC (HARD DISK PROTECTION)	185 00	AMDEK. 1280 MONITOR	T1000 512KB ONE 3 1/2" DRIVE 4.77MHz CALL
SOFTWARE GROUP. ENABLE V 2.0	399.00	Elite Business. Design VIEW/19 (1280X10241595.00	T1200 1MB 20MB HD, ONE 3 1/2" DRIVE CALL
SOFTWARE PUBLISHING		Elite Business. Design VIEW/19 (1280X1024)595.00 PGS. MAX-12 (MONO MONITOR)	T3100/20 640KB ONE 3 1/2", 20MB HD CALL
HARVARD TOTAL PROJECT MANAGER		FGS. ULTRASYNCH EGA MONITOR 589.00	T5100 2MB RAM ONE 3 1/2", 40MB HD CALL
P.F.S. GRAPH/PLANe FIRST CHOICEe		N E C. MULTISYNC II EGA	WYSE 2112 1.2MB DRIVE 1MB RAM 8/12 MHz CPU,
PROFESSIONAL FILE/PLANe	a. 159.00	WYSE. 700 1280X800 HI RES. MONITOR 789.00	101-KEY KEYBOARD MS DOS 3.1 CALL
PROFESSIONAL WRITE	139.00	MODEMS	PC 386 (16MHz) ZERO WAIT-STATES 1MB
SYMANTEC. Q&A 3.0	259.00	<b>EVEREX.</b> EVERCOM 1200 (Internal) 109.00	RAM,1.2MB DRÍVE,KEYBOARD,MS DOS 3.2
WALLSOFT THE ULPROGRAMMER	100.00	<b>EVEREX. EVERCOM 2400 (Internal)</b> 199.00 <b>HAYES.</b> SMARTMODEM 2400	(8MHz) MODE, SERIAL/PARALLEL PORT CALL HAUPPAUGE COMPUTER WORKS.
THE UI PROGRAMMERTHE DOCUMENTOR		HAYES. SMARTMODEM 2400	80386-16MHz REPLACES IBM/XT MOTHER
WORDPERFECT CORP		HAYES. 1200B+SMARTCOM II	BOARD. 1MB RAM, FIVE 8-BIT (2 SHORT),
WORDPERFECT V 5.0	CALL	HAYES. 2400B+SMARTCOM II	2-16 BIT, 1-32 BIT SLOTS & SOCKET FOR 80387.
WORDTECHSYSTEMS		MIGENT. 1200 POCKET MODEM 139.00	WORKS WITH MOST PRESENT HARDWARE
D B X LQUICK SILVER DIAMOND	99.00 369.00	MIDI PRODUCTS MUSIC QUEST	INCLUDING HARD/FLOPPY DISKS DRIVES & KEYBOARD, OS/2, 1-2-3 (V2.01), dBASE.
XYQUEST.XY WRITE III +	399.00	MIDI Co-Processor Card	KEYBOARD, OS/2, 1-2-3 (V2.01), dBASE, AUTOCAD, VENTURA, WINDOWS & OTHER
GRAPHIC & DESK TOP PUBLISHING		Starter System+	MAJOR SOFTWARE COMPATIBLE 1495.00
ALDUS. PAGE MAKER	CALL	Starter System	
ASHTON TATE CHART/DIAGRAM/SIGN MASTER	CALL	TWELVE TONE SYSTEMS CakeWalk 2.0 Sequencer	THIS AD WAS PREPARED USING HPLJ II VENTURA & IMAGEN PC PUBLISHER'S KIT
STATTERACTAM/SIGN MASTER	OALL	TERMS AND CONDITIONS	VENTORIA GIMAGENTI O PODEIGNERI O IMI

CakeWalk 2.0 Sequencer ....

TERMS AND CONDITIONS

We reserve the right to repair, replace or return to manufacturer for repair, all goods acknowledged faulty or damaged on receipt by customer. Customer Must Call For Return Authorization Number Before Returning Any Goods. Prompt attention will be given to all damaged and faulty returned goods. Any goods returned for credit are subject to 20% restocking charge, plus shipping charge. No Returns For Credit On Any Software. Customer must deal directly with the manufacturer if the customer finds any false claims made by the manufacturer. All goods are shipped VIA U.P.S. ONLY. Shipping charges are 2% of the total purchase price or \$3.00, whichever is greater. Please call for shipping charges on Printers & Accessories. C.O.D. goods are shipped for Cash or Cashier's Check Only. Max \$1500.00. Please allow 7 to 10 working days for personal or corporate checks to clear. To expedite shipping send money order or cash ier's check, or charge to your VISA OR MASTERCARD. WE DO NOT Add a Service Charge For Credit Card Usage. PRICES SUBJECT TO CHANGE WITHOUT NOTICE. NOT RESPONSIBLE FOR TYPOGRAPHICAL ERRORS.

Orders, Call Toll Free

1-800-888-2983

Tech Support & Information 1-612-881-9197

Mailing Address: 9801 Dupont Ave. So., Suite 175 Bloomington, MN 55431

ORDER DESK & TECHNICAL SUPPORT OPEN: M-F 9a.m.-5p.m. CST

## **EVEREX** Model 3000A 16MHZ-386

- •64 K Static RAM cache
- •1 MB-100NS Dram
- •1.2 MB Floppy
- Hard drive floppy controller

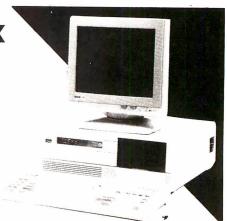
\$1895.00



## **EVEREX** Model 1700C 2MHZ-286

- •1 MB 100NS Dram
- •1.2 MB Floppy
- ·Hard drive floppy controller

**\$1295.00** 



National On-site Warranty Service Available on ALL EVEREX Computers

# **EVEREX** Model 1800 8MHZ-286

- •512 K RAM
- •1.2 MB Floppy
- ·Hard drive floppy controller



Citizen

### **LAPTOPS**

#### **Toshiba**

T-1000
T-1200H2349.00
T-32003795.00
T-51004829.00

**NEC** Multispeed

Call

#### HARD DRIVES

MAXTOR
1140 140 MB
2190 190MB
4380 380MB
MICROPOLIS
1333A 44MB
1335A 72MB
SEAGATE
ST-225 w/Controller, 20MB
ST-238 w/Controller, 30MB
ST-251 40MB
ST-4096 80MB

#### **MEMORY EXPANSION**

RAM 10000 10MB EMS w/OK . . . . . . . . . . Uses 1MB Chips

#### MATH COPROCESSORS

#### **PRINTERS**

NEC LC-890 Laser
Okidata 393
Panasonic
Toshiba
MODEMS
Everex 1200B Int
Everex 2400 Bd Int
Everex EFAX Modem Ext329.00

#### \* SPECIAL \*

Miniscribe 3675-65MB Hard Drive w/Adaptec 2372 Controller .

#### TAPE BACKUPS

Everex 60MB	Internal	¥.											. 679.00
Everex 60MB	External	١,											.759.00
Mountain 40N	ИВ		,		·			٠	٠		•		. 379.00

#### POWER BACKUPS

Stedi Watt 750VA	 . 599.00

#### **MONITORS**

MITSL	ID	115	18	11																	į.						. Cal	ı
Sony												913				e											. Cal	ı
NEC																												
Everv	is	ii	10	1	E	=(	G	A						. ,	9										. ;	3	59.00	)

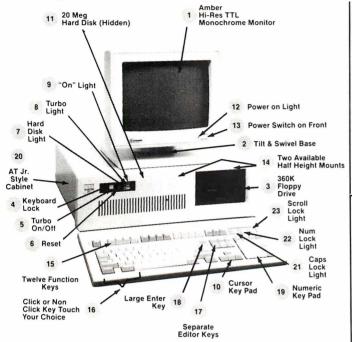
#### VIDEO CARDS

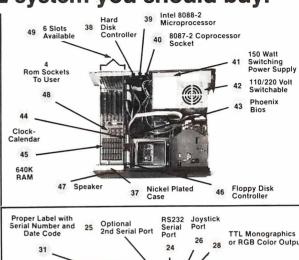
ATI		9.0			 						 	٠.	,			,	 	Call
Everex EGA .		,		×		·								,			. 139	.00
Paradise 480																	. 159	00.6
Everex EVGA						•	•				×						. 269	9.00

#### WELCOME EDUCATION AND CORPORATE ACCOUNTS

# FAST MASTER" III

# XT Turbo Professional Model 56 Reasons why this is *THE* system you should buy!





Proper Label with Serial Number and Date Code

31

Air Cooling Fan I.D. Code

34

Auxiliary Power Outlet

Proper Label with Serial Number Results Serial Port Port 26 28

Auxiliary Power Outlet

TTL Monographics or RGB Color Output

35

Keyboard Connector Rubber Feet

36

Auxiliary Power Outlet

27

Parallel Printer Port 29

Bus Mouse Port

51 Standard or AT Jr. Case

52 30-Day Money-Back Guarantee

53 2 Year Limited Parts/Labor Warranty

54 48 Hour Burn-In Testing

55 FREE Utility Software

56 All This for only \$99700

#### **About CORTEX Corporation**

When you're looking for Personal Computers, peripherals, accessories, or supplies at the best price available \*PLUS\* the priceless support you just can't get from the warehouse stores . . . CORTEX is the place.

When you are tired of being "sold" something, we invite you to a refreshing break. Contact us today. Our experienced staff is dedicated to consistency, courtesy, and reliability. Our philosophy is to provide you with the product or service that not only fits your budget, but also your requirements. We feel you should get what you're looking for without paying for unnecessary extras.

You must have VALUE. You deserve to be helped by a professional organization instead of a professional salesperson. Our staff is made up of computer professionals, engineers, and technicians who absolutely MUST help you get the most for your dollar.



Corporate P.O.s Government Agencies Universities

**WELCOME** 

**CORTEX CORPORATION** 

1-800-458-1740

Tech Support 1-612-888-8693

9401 James Ave. S., Bloomington, MN 55431



SMART MICRO (E) 10 MHZ Compatibility — by far the best and most compatible bios We guarantee that MS-DOS software will operate flawlessly: Lotus, Symphony, Flight Simulator, Wordstar 2000, Word DBase, RBase, the list goes on and on.

Turbo Speed - 4.77 mhz to 10 mhz both keyboard and

512K Memory — High quality pre-tested chips on a 1MB

FREE Hercules compatible high resolution amber monitor and graphics card.

We even give you a tilt and swivel based monitor for your

One high quality 360K floppy drive. (Our head technician

Continuous and heavy duty 150 Watt power supply (15

Watts more than most competitors)

A battery backed-up clock/calendar

1 serial port - you can add a second

1 parallel port for your printer.

Smart Micro E with hard drive

. 1 game port for joy sticks.

. A slot for a math co-processor chip 8087.

· AT Style Keyboard with 10 Function Keys

Expandible to 1MB with FREE Extended Memory Software.

 Turbo light — No guessing! If it's on, it's Turbo . 8 expansion slot motherboard

software selectable.

#### You're in Good Company With Micro Smart!

In addition to the thousands of home-users who rely on Micro Smart, our corporate clients

e University

Include: New England Power
University Of Alabams
Boston University
Georgia Tech
Granite State Power
Harvard University
Holy Cross University of Hartford University of Pennsylvania U.S. Government Mass Flectric



- . 8/16MHZ, no wait states (16/20MHZ Optional)
- Compatibility by far the best and most compatible bios. We guarantee that MS-DOS software will operate flaw-lessly: Lotus, Symphony, Flight Simulator, Wordstar 2000, DBase, RBase, the list goes on and on...

  1024K-memory High quality prefested chips (80 NS)
- Battery backed up clock calendar 1 parallel port.
- 1 Serial Port (second port \$20.00 additional
- 8 full expansion slots
- Enhanced Keyclick Keyboard (101 key).
- Hercules compatible graphics card. High-resolution monochrome monitor with a till
- 1.2MB floppy drive.
- 3 half-height external access device bays. 2 half-height internal device bays.
- 200 watt power supply.

42 to 204 megabyte drives installed . . . from \$499.95

### **NETWORKS** SMART LINQTM

your problems see next page.

#### 10MHz (Optional 12MHZ - "0" Wait State) Smart Linq" Novell Unix & Xenix Compatible

- Compatibility by far the best and most compatible bios. We guarantee that MS-DOS software will operate flaw-lessly: Lotus, Symphony, Flight Simulator, Wordstar 2000, Word, DBase, RBase, the list goes on and on...
- · 8 expansion slots to fill all of your expansion needs
- Turbo light No quessing, If it's lit, it's Turbo.
- 512K memory High quality pre-tested chips (upgrade able to 1MB on the motherboard).
- FREE Hercules compatible high resolution amber monitor and graphics card.
- We even give you a tilt and swivel based monitor for your comfort.
- One high quality floppy drive. 1.2 meg or 360 K. (Our head technician checks each one.)
- 200 watt power supply.

Sa E E Y II

- AT style keyboard with 10 function keys
- 1 parallel port.
- Slot for a Math Co-processor 80287
- A clock calendar for automatic time and date w/batter backup.
- FCC Class B Approved.

AT/286 systems complete with Hard Drives

WHEN QUALITY, PRICE AND SERVICE COUNT

21 megabytes - complete system ...... \$999.95 33 megabytes - complete system ...... \$1049.95 42 megabytes - complete system ...... \$1099.95

SERVICE
No one does it better! Shipments are made
Monday through Friday. \*All In-stock items
are shipped the same day if your order is
placed by 2:00 p.m. Orders placed after 2:00
p.m. are shipped the next business day.

Long waits for your system? NEVER! Order! TECHNICAL ASSISTANCE
by 2:00 pm on anyweek day and, if in stock we
will ship it that day. Microsamar provides you
with service all year round!
All of our computers are given a primary burnfor 48 hours and after setup, are burned again
for 72 hours. We then configure YOUR system
and diagnostically check it out.

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

872:9002

Ind them anxious to be of service. Call (617) 872-9090. MONEY BACK GUARANTEE Absolutely. We don't want you to have a product that you aren't happy with, Just let us know within 21 days of receipt and, upon return, we will give you a refund (less shipping handling and insurance).

NIX ROM

ALL of the systems shown come with PC-WRITE word processor, PC-CALC PC-DESKTEAM,

200 Homer Avenue, Ashland, MA 01721 1-508-872-9090

FAX: 508-881-1520

TRADEMARKS: IBM Corp.; Lotus Development; Tandy Corp.; Microsoft, Inc.; Micro Smart, Inc.; Novell; NEC; Smart-Linq.

°1988 Micro Smart, Inc.

# Your answer to

### ORDER TOLL FREE! 1-800-333-8841

(Orders Only) Technical Assistance (508) 872-9090

Order by 2:00 p.m. shipped by 5:00 p.m.

#### **SMART MICRO OPTIONS**

0	
(Sold wi	th System)
EGA exchange with EGA monitor	80287 math
and EGA card (640 x 350 resolution)	coprocessor \$CALL
\$449.95	Tactile 101 key enhanced
VGA exchange with 100%	keyboard \$25.00
hardware compatible EGA, CGA,	DOS 3.3 \$CALL
and Hercules (800 x 600	Mouse \$69.95
resolution)\$699.95	300/1200 baud modem
CGA exchange complete with	w/software \$69.95
CGA Card and Monitor \$210.00	2400 baud modem
(EGA, CGA and Multisync exchange	w/software \$149.95
replaces monochrome card and	360K floppy disk drive \$89.00
monitor.)	3½" floppy disk
	drive from \$115.00

#### Custom Configuration— **Our Specialty!**

If you don't see what you want here, we will build it to suit you. Just ask.

#### **TERMS & CONDITIONS**

The prices quoted here are for cash. We will accept MasterCard, VISA, Discover and American Express. C.O.D.'s are accepted without any deposit. Purchase Orders are accepted based on prior approval. Call today for details. Prices subject to change without notice. Not responsible for typographical errors.

21 day money back guarantee less shipping. handling and insurance.

**88NE-8** BYTE • OCTOBER 1988

# SMART-LINQ™



EASY

INSTALLATION

We prepare the system for you

(standard or custom configuration).

IT IS READY TO USE

With

SMART-LINQ"

you just

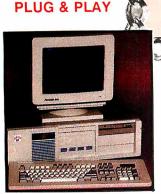
#### **SMART-LINQ™**

**NOVELL STYLE NETWORK** 

(complete with software and cables)

# ISSING





#### SMART-LINQ" - SMART FEATURES

■ DEDICATED FILESERVER? NO!

Any station in our network can be established as the file server. Unlike many networks, you do not need to dedicate a specific unit as a file server with SMART LINQ".

- FILE & RECORD LOCK? YES!
- 2 YEAR WARRANTY!!
- UP TO 254 STATIONS
- UP TO 10 MEGABIT TRANSFER
- UP TO 3,000 FEET (with repeater).
- INSTALLED IN LESS THAN 15 MINUTES

HE DUAL-USER"

ADD STATIONS

WITH EASE

The system will handle from two to

254 work stations. Add a station whenever you need to.

With

you just

**PLUG & PLAY** 

SMART-LINQ™

#### SMART LINQ"

#### Starts at \$2999.00

#### 2 STATION NETWORK

- AT 286 Server Workstation.
  with 40 megabite 640K
- XT8088 Workstation.
- SMART LINQ" Software and
- DOS 3.3A 25 Ft. of Cable
- Software Installed Ready To Run.

#### SMART LINQ"

#### Starts at \$3949.95

#### 3 STATION NETWORK

- AT 286 Server Workstation.
- with 40 megabite 640K
- Two XT8088 Workstations.
- Three SMART LINQ Cards.
  SMART LINQ Software and
- DOS 3.3A
- 50 Ft. of Cable.\*
- Software Installed Ready To Run

#### SMART LINQ™

#### \$4899.95

- **4** STATION NETWORK
- AT 286 Server Workstation.
- with 40 megabite 640K. Three XT8088 Workstations.
- Four SMART LINQ" Cards.
- SMART LINQ™ Software and
- DOS 3.3A. 75 Ft. of Cable.\*
- Software Installed Ready To Run.

#### NETWORKING PACKAGES

SMART

LINO"

XPANSION MODULE

- \$999.95
- 8088-2 Computer complete
- 640K of Memory
   SMART LINQ® Board and Software

#### **COMPLETE PACKAGE**

☐ Set Up In Minutes

□ 2 Stations Networked

□ 12 MHZ 80286 System

□ No Speed Degradation

☐ Operate as 2 Separate A.T.'s

(Everything You Need)

\$2499.95

\* You may purchase additional cabling and alter the actual cable lengths.

#### 2 YEAR WARRANTY

We are confident of our product. Therefore we offer you a two year repair or replacement, at our option, warranty on all parts of our Smart-Ling" Network except cables. Just ship your unit to us freight prepaid and we will ship it back within 24 hours of arrival.

#### AFTER WARRANTY SERVICE

As a team, we have been serving you since 1981. We know how important it is or you to be up and running. In and out of warranty service is treated the same, YOU'RE IM-PORTANT TO US! All repairs are done within

For technical assistance call (508) 872-9090.

#### **ORDER TOLL FREE!** 1-800-333-8841

(Orders Only)

TECHNICAL ASSISTANCE (508) 872-9090

Our hours are from 9:30 a.m. to 5:30 p.m. E.S.T. Monday through Friday and from 10:00 a.m. to 4:00 p.m. E.S.T. on Saturday



200 Homer Avenue, Ashland, MA 01721 FAX: 508-881-1520

TRADEMARKS: IBM Corp.; Lotus Development: Tandy Corp.; Microsoft, Inc.; Micro Smart, Inc.; Novell: NEC: Smart-Ling.

OCTOBER 1988 • B Y T E 88NE-9

# 



At UNIQ Tech, **NERDS** are respected. In fact they're revered. When it comes to building top-notch IBM compatible computers, no one works harder or is more concerned with quality than our nerds. **NERDS** is an acronym for **N**ouveau **E**ngineering **R**esearch and **D**evelopment **S**pecialists. UNIQ Tech is owned and operated by engineers. This assures you that what you purchase will be evaluated, tested and scrutinized by true 'blue' (pardon the pun) professionals. Perhaps that's why 80% of our customers are dealers who specialize in networking. CAD/CAM and other complex operations that would maim a lesser computer.

Decide for yourself. Call the company that will work harder for you. UNIQ TECH, the company with NERDS.

# Complete Solutions

#### **COMPUTERS**

#### **OPERATING SYSTEMS**

#### **NETWORKS**

80386(16,20MHZ) 80286AT(10,12MHZ) 8088XT(4.77/10MHZ) PORTABLES TERMINALS

DOS SCO-XENIX-386 SCO-XENIX-286 ETHERNET
ARCNET
NOVELL
D-LINK
3COM

# UNIQ TECHNOLOGY, INC.

165 D New Boston St., Woburn, MA 01801 (617) 935-7150

# Competence.



Computer Resource Center Inc. 209 Broadway Methuen, MA 01844

# At CRC we think competence is worth pursuing.

There was a time — not so long ago — when anyone could configure a PC out of IBM-standard components and off-the-shelf software and call himself a systems integrator.

That time is gone.

To make a 25-MHz 80386 system or a high-performance network actually *work* you need know-how — hardware know-how, software know-how, system know-how, and application know-how. Know-how acquired through hands-on experience — not out of a catalog. In short, competence.

You also need to listen to what your customer wants and needs, and adapt the manufacturers' "standard" products to fit those needs. Which we do. Every day.

We use only certified, quality components, like ALR computers, Novell Netware, Thomas-Conrad Arcnet cards... and we make

sure they all work together as a system before they leave our shop — because it's your business on the line.

Why not call CRC now? Find out how refreshing competence can be.

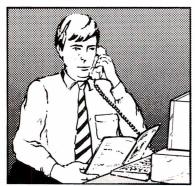
(508) 689-9795





#### Buy with

# Confidence



In an effort to make your telephone purchasing a more successful and pleasurable activity, The Microcomputer Marketing Council of the Direct Marketing Association, Inc. offers this advice, "A knowledgeable buyer will be a successful buyer." These are specific facts you should know about the prospective seller before placing an order:

# Ask These Important Questions

- How long has the company been in business?
- Does the company offer technical assistance?
- *Is there a service facility?*
- Are manufacturer's warranties handled through the company?
- Does the seller have formal return and refund policies?
- *Is there an additional charge for use cf credit cards?*
- Are credit card charges held until time of shipment?
- What are shipping costs for items ordered?

Reputable computer dealers will answer all these questions to your satisfaction. Don't settle for less when buying your computer hardware, software, peripherals and supplies.

#### Purchasing Guidelines

- State as completely and accurately as you can what merchandise you want including brand name, model number, catalog number.
- Establish that the item is in stock and confirm shipping date.
- Confirm that the price is as advertised.
- Obtain an order number and identification of the sales representative.
- Make a record of your order, noting exact price including shipping, date of order, promised shipping date and order number.

If you ever have a problem, remember to deal first with the seller. If you cannot resolve the problem, write to MAIL ORDER ACTION LINE, c/o DMA, 6 E. 43rd St., New York, NY 10017.

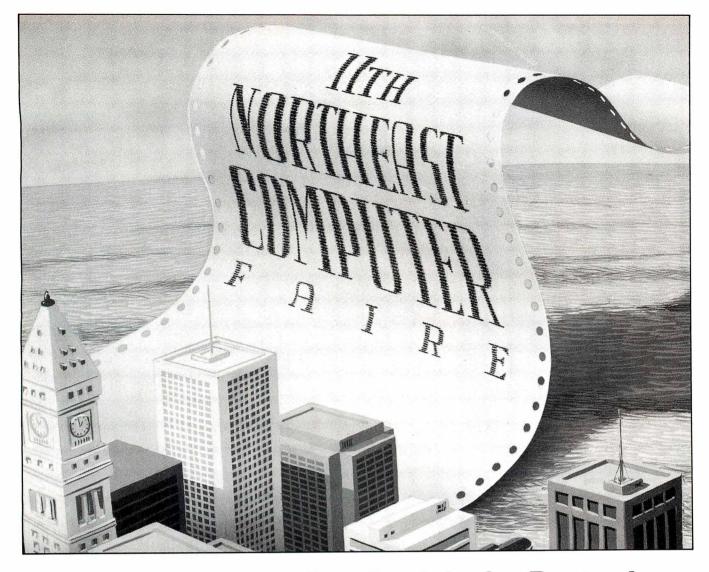
ME COPIFUTEE

This message is brought to you by:

the MICROCOMPUTER MARKETING COUNCIL of the Direct Marketing Association, Inc. 6 E. 43rd St., New York, NY 10017

MICROCOMPUTER MARKETING COUNCIL of the Direct Marketing Association, Inc.





#### Giant Wave Heading Straight for Boston!

It's coming. The wave of information and resources you need to run your business, your home office, or for your personal use, in an efficient, costeffective way. The wave is coming to the Hynes Oct. 27-29.

Whether you're in architecture, education, engineering, manufacturing, law, government, healthcare, construction, real estate, accounting, or finance, you'll get right to the product for your specific needs with our Vertical Market Matching Program.

#### See What's Hot In Computer Graphics

You'll experience everything from Desktop Publishing, presentation graphics, graphics software, to lowcost CAD systems and more. And all will be explored in focused conferences.

The information wave at the Northeast Computer Faire is co-sponsored by the world's leading computer user group, the Boston Computer Society

and its 29,000 member information and education network.

Brace yourself for hundreds of exhibits for the professional small systems user, with a huge variety of computers, software, accessories, services and peripherals. At the best prices in town.

The 11th Northeast Computer Faire's information wave hits the Hynes Convention Center Oct. 27-29. Riding the wave of imagination for your computer needs.

#### THE IITH HORTHERST COMPUTER

October 27-29, 1988 Hynes Convention Center, Boston, MA

Co-Sponsored by **GOCO** The Boston Computer Society sm

#### Register Early And Save \$4.00!

Fill out this coupon and mail with your check for \$11.00 for each registrant, postmarked by October 8, 1988.

Include the names and addresses of each registrant for whom you are enclosing a check. (Photocopy coupon for additional registrants.)

Company

Address City

State Zip

Three day conference and exhibits \$11.00 in advance, \$15.00 at the door. Make check payable to "Northeast Computer Faire." Mail to: Attender Registration Department, Northeast Computer Faire, 300 First Avenue, Needham, MA 02194. Advanced registrations accepted only with full payment and each registrant's name and address. Tickets will be mailed to each individual registrant separately

To exhibit, call (617) 449-6600, ext. 5028.

Produced by:

#### MITHE INTERFACE GROUP, Inc. .

World's Leading Independent Producer of Conferences and Expositions

300 First Avenue • Needham, MA 02194

©1988 The Interface Group, Inc.

# I fimited Edit





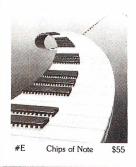


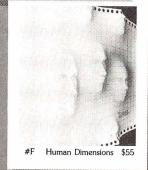












You've seen them on the pages of Byte now enjoy these delightful images as stunning limited edition prints! Each exquisite, 16" × 20" reproduction is part of an edition strictly limited to only 1000 prints. The museum-quality paper is an acid-free, 100% cotton fiber stock (highly resistant to yellowing or cracking) which will preserve image color and brightness for generations.

The artist, Robert Tinney, personally inspects, signs and numbers each individual print. Accompanying the print is a Certificate of Authenticity (also signed and numbered by Tinney) which verifies the number of the edition and the destruction of the press plates.

The price of each print depends on the number of unsold prints in the edition, and is shown beneath the photos at left. If your

order exceeds \$100, deduct 15%. All prints are shipped flat via UPS Blue Label, and carry an unconditional 30-day guarantee.

To order, clip the coupon below. VISA, MasterCard or AmEx orders may call 1-318-826-3003.

VECI	Sand	+b	a falla.	D. 4	- T !!4-	d Editions

QTY.	#	TITLE	AMOUNT
			\$
			\$
			\$
			\$
			\$
			\$
		If your order exceeds \$100, deduct 15%.	\$
		\$4 postage & handling (\$25 overseas).	\$
show I hav C.O.I	ving yo ve enclo D. (via	or brochure  Jur other prints.  osed U.S. check or money order.  b UPS—stateside orders only)  MasterCard  American Express	\$
Card #:			

Expires: \_\_\_\_ \_\_ Signature: \_\_

SHIP MY PRINT(S) TO:

Country: \_

Name: .

State:

Mail this coupon to:

**ROBERT TINNEY GRAPHICS** P.O. Box 778 • Washington, LA 70589

For VISA, MasterCard or American Express orders, or for more information CALL 1-318-826-3003



# Instant envelopes from any HP compatible laser printer

If you use a laser printer, you already know that laser printers do a great job with pages, but they're awful when it comes to envelopes.



First, you have to select the landscape mode, then pick a font code, and finally you have to position the name and address at just the right place on the screen and hope it comes out right on the envelope.

Even for a single address! That's why even though laser printed envelopes look much better, most users give up and type their envelopes on a standard typewriter instead. Getting those crisp font styles onto envelopes is just too complicated.

Until now.

Introducing ERMASOFT Laser Envelopes 2.0, the smart envelope utility for HP compatible laser printers.



ERMASOFT Laser Envelopes 2.0 lets you print any of your laser printer's internal, cartridge or soft fonts. And it can even mix up to four different styles on each envelope.

ERMASOFT Laser

Envelopes 2.0 also lets you capture a name and address directly from your application with a pop-up, 5K memory resident, cut-and-

paste utility.

It grabs the name and address from the screen and stores it in memory. You can even capture more than one and save them to disk in a batch file.

Or, use
ERMASOFT Laser
Envelopes 2.0 from
the DOS prompt and
enter an entire list. It's
ideal for frequent business
mailings that need a
personalized look.

And ERMASOFT Laser Envelopes 2.0 not only prints envelopes that look great; it's easy to use, too. Forget those clumsy landscape and font settings. You won't need to change a thing on your printer.

Once you've installed your choices, ERMASOFT Laser Envelopes 2.0 gets it right every time.

And ERMASOFT Laser Envelopes 2.0 handles a wide range of envelope sizes from a small 3"X5" to a large  $8^{1}/_{2}"X11"$ . It even does postcards and direct-mailers. No other program

ABC Corporation Att: Mr. Robert Smith 123 Oak Street Anytown, USA 10000

is as easy to use or as convenient, nor as economical—ERMASOFT costs only \$49.95 plus \$3 shipping and handling.

Its small cost and big value will enhance your laser printer investment, as well as the look of your correspondence.

In fact, we're so confident that you'll be completely satisfied, we guarantee it. If for any reason you don't agree, return it within 30 days for a full refund.

Use your Visa or MasterCard and order now. And make your envelopes look as good as what's in them.

#### 1-800-288-ERMA

ERMASOFT.

(LASER ENVELOPES 2.0)

E.R.M. Associates, 29015 Garden Oaks Court, Agoura Hills, CA 91301

HP is a registered trademark of Hewlett-Packard Company © 1988 E.R.M Associates



# No disks. No DOS





#### THE MOST PORTABLE, FULL FUNCTION COMPUTER EVER MADE.

- No disks, or disk operating system
- 8.25" x 11.5" x .875", weighs less than 2 lbs., goes anywhere
- 32K of built-in memory, expands to over 1.5 megabytes
- Powerful applications software
- Supertwist LCD display, 8 lines x 106 columns
- QWERTY keyboard with silent travel keys
- Operates on 4 AA batteries for 20 hours
- PCLink imports/exports Wordstar, Lotus 1-2-3, and ASCII files
- Solid state Memory Cartridges™ for added memory
- Permanent storage of contents on EPROM Memory Cartridges™

### The Cambridge Z88,

#### not the average personal computer.

The Cambridge Z88 wasn't designed to be the average personal computer. In fact, the Cambridge Z88 is the first in a new generation of personal computers, unlike any computer ever seen before.

Operating without disks or a disk operating system, the Z88's internal software enables you to move easily from task to task without booting, loading, opening, saving or quitting. Replaceable solid state Memory Cartridges<sup>™</sup> add to memory capacity, operating ease and program capacity.

Designed by Clive Sinclair who introduced the breakthrough Sinclair ZX80, 81 and QL, the Cambridge Z88 is compact, lightweight, and powerful enough to be used anywhere; just switch it on.

The best news about the Cambridge Z88 is the price; you pay less for this personal computer than you would for some PC software and peripherals-\$599.00. And it won't cost you anything to try the Cambridge Z88 yourself.

#### Architecture

The Cambridge Z88 is designed with four chips: a CMOS Z80; a 32K RAM (expandable to over three megabytes); a 128K ROM for the operating system, powerful BASIC, and built-in applications (word processor, spreadsheet, daily date manager, etc.); and custom controller chip.

The Cambridge Z88's memory is expandable with replaceable solid state RAM and EPROM Memory Cartridges<sup>T</sup> that fit into three easy to access slots under the keyboard. The EPROM cartridges retain their contents when removed from the Z88.

Task switching

With Instant  $On^{TM}$ , there's no booting, loading, opening, saving, or quitting. When you want to work on a new task, press the INDEX key to display a list of applications and files; then select one. The task you were working on will be instantly saved. Switched off, the Z88 automatically saves your work; turn it on again, everything appears exactly as you left it.

**Operating features** 

Display: 8 lines by 106 column supertwist LCD display with 80 columns of work area, including page map with a view of the entire page and command menus. Keyboard. A full sized, easy to use QWERTY keyboard with silent travel keys. Context sensitive command menus can be opened to display all of the available commands and their keyboard equivalents.

#### Communications

OTY

The Z88 has an RS232 port for a printer (serial and parallel cables are available), modem, and a PCLink enabling ASCII,

Wordstar, and Lotus 1-2-3 files to be transferred to and from your PC.

ITEM PACK & TOTAL EXTEND

Memory Cartridges™ are available in 32K, 128K, and 512K

#### Put the Cambridge Z88 to the test for 15 days,

Test the Z88 for the next 15 days and discover what the next generation of personal computers will be like: at work, travel, home, use the Z88 anywhere. You will also receive free, a one year subscription to CompuServe, the nation's electronic bulletin board. If you decide not to keep the Z88, return it for a complete refund.

#### and get free, a one year \$40.00 subscription to CompuServe

the electronic communication network bulletin board.

- **■** Electronic Mail
- Bulletin Board
- User Forums
- Computing Publications
- New software and hardware

#### The Cambridge Z88 computer

Includes a one year limited warranty, manual, and lightweight carrying case.

Circle 509 on Reader Service Card

#### CAMBRIDGE

#### R E

1419 Lake Cook Rd. Suite 300 Deerfield, IL 60015 1-312-940-1554

For Z88 dealer locations or questions about the Cambridge Z88, call the Cambridge product support team at 1-800-435-7729.

#### ORDER FORM

Telephone (	)
	Apt
State	Zip
Money order no	Amount \$
Card no	Evn data
	State Money order no

ORDER BY PHONE: To order by phone with a credit card, call 1-800-435-7729 from 10am to 7pm, Monday through Friday, Central time, and ask for Operator 10. Please have card name, number, and expiration date ready when ordering.

Cambridge Direct will express your Z88 within 48 hours after receipt of order.

TT DA	PRICE	SHIP	PRICE	PRICE
8000 Z88 Computer	599.00	12.00	611.00	
8201 32K RAM Pack	45.00	3.00	48.00	
8202 128K RAM Pack	110.00	3.00	113.00	
8210 32K EPROM Pack	45.00	3.00	48.00	
8211 128K EPROM Pack	110.00	3.00	110.00	
8220 IBM PC Link II	75.00	3.00	78.00	
8230 Serial Cable 9M to 25F	22.00	3.00	25.00	
8231 Parallel Cable 9M to 36M	65.00	3.00	68.00	
8240 Modem and Cable	259.00	5.00	264.00	
8232 AC Adapter	9.95	3.00	12.95	
Illino	is residen	ts add 7%	sales tax	
		TOTA	L ORDER	
	8000 Z88 Computer 8201 32K RAM Pack 8202 128K RAM Pack 8210 32K EPROM Pack 8211 128K EPROM Pack 8220 IBM PC Link II 8230 Serial Cable 9M to 25F 8231 Parallel Cable 9M to 36M 8240 Modem and Cable 8232 AC Adapter	PRICE	PRICE   SHIP	PRICE   SHIP   PRICE

#### SHORT TAKES

#### BYTE editors offer hands-on views of new products

3-in-One P321SLC

Illustrator 88

AppleCD SC

Super PC-Kwik

PolyBoost II

Tickler/2

Zortech Comm Toolkit



#### Toshiba 3-in-One: The Colorized Version

oloring movies has gotten Ted Turner a lot of criticism, but no one can object to what Toshiba has done to its 24-pin dot-matrix printer. Besides being fast and capable of high-resolution printing, the new Toshiba 3-in-One P321SLC can print in four colors and can produce some remarkable output. Using combinations of the cyan-magenta ribbon, you can get output in up to seven colors, including black. Green, orange, and purple can be simulated.

Assembling the printer and setting up the paper feed takes about 3 minutes, but once the mechanical requirements are taken care of, changing configurations is a breeze. The front panel's four switches and liquid crystal display let you access all the configuration parameters through layers of setup menus. More common parameters (e.g., font, pitch, and emulation) are available in the first layer, while everything from RAM allocation to horizontal registration can be adjusted if you care to delve deeper.

The printer comes with 34K bytes of memory that is shared between the print buffer and

#### THE FACTS

Toshiba 3-in-One P321SLC \$949

Interfaces required: Centronix parallel or 25-pin RS-232C.

downloadable fonts. There are two card slots on the front of the machine for optional 32Kbyte RAM modules or font cards. My evaluation system came with two font cards, which let me access a total of five typefaces. Courier, Prestige Elite, and High Speed are the standard ones. Typefaces can be scaled between 10 and 20 points.

Printing speed varies from job to job, but the P321SLC is always noticeably fast. Draftquality documents zoom by at a rated print speed of 216 characters per second, while letter-quality printing is rated at a respectable 72 cps. I timed one letter-quality sample and found it took about 50 seconds to print a little less than 2000 characters. For the average text job, expect to wait about a minute per page.

Toshiba America Inc. **Information Systems** Division 9740 Irvine Blvd. Irvine, CA 92718 (714) 583-3000 Inquiry 851.

Resolution is excellent, as is typical of 24-pin printers. The clarity really shows on fine line graphics and small, narrow typefaces like Prestige Elite. The print head is pinaddressable and can provide graphics at up to 180 by 360 dots per inch.

While printing in color provides you with a versatility you can't achieve in monochrome, it also opens doors to a few problems. The biggest problem I had was finding drivers in my applications that would let me print in color. The P321SLC supports three emulations: Toshiba/Qume, IBM Proprinter, and IBM Color Printer. While applications often include Toshiba drivers, several notable packages-ACAD 2.52 and Dr. HALO III 3.0, among others—support only the monochrome versions, and you are forced to fall back on IBM emulation.

The detailed 268-page user's manual has a technical reference section that describes all the ASCII escape sequences. Using these, I generated color text by embedding the commands in XyWrite. Instructions are included for creating color text using MultiMate and other popular packages. I printed several graphics images using Harvard Graphics 2.10. Narrow line images like maps and mechanical design plots turned out very well, while more filled drawings tended to show lines where the printer had made repeated passes.

The new 3-In-One adds color to a fine line of Toshiba printers. With this and other dot-matrix printers becoming more and more affordable, high-resolution color may well be the common output of the future.

-Steve Apiki

#### Illustrator 88: **PostScript Drawing Gets Better**

dobe's Illustrator and Aldus's FreeHand are like two great baseball teams slugging it out, with one team going ahead in the top of the inning and the other team coming back to scratch out the tying and go-ahead runs.

Adobe batted first in 1986 and scored impressively with Illustrator, which established a whole new class of drawing program that uses the Post-Script language to create artwork made up of lines and Bézier curves. Earlier this year, Aldus tied the score and

went ahead with FreeHand, which does wonders with colors and had on its roster one thing Illustrator lacked: a freestyle drawing tool. And now Adobe has sent up Illustrator 88. The score has definitely changed.

The new Illustrator has a freestyle drawing tool, which works like the pencil in Mac-Paint. This addition to the toolbox gives you considerably more freedom when you're working on an illustration. The program is primarily for producing clean lines and curves-which you do by laying down a series of anchor points and then having the program connect them—but there are times when you need more flexibility than the connectthe-dots approach provides.

Another big change to the Illustrator lineup is an automatic tracing tool, a significant feature lacking in Free-Hand. Both programs let you take an image and use it as a template; using different tools, you trace over that template and then use the tracing (the top layer), which looks much more polished than the original, in your illustration. This process is how these PostScript drawing packages, with their skill at producing clean, perfect lines, let you transform a rough sketch into a sharp, well-defined piece of artwork. Illustrator 88's autotrace tool makes tracing a rough image a painless-and very fast-process. A brilliant addition.

Illustrator can now do fourcolor separations—one area where FreeHand had gone ahead-but uses a separate utility to handle the process, whereas FreeHand does it from within the application. Adobe has added the glorious Pantone palette of colors, which you can also use to make custom colors of your own. If you're lucky enough to have a Macintosh II and a color monitor, you'll be able to produce graphics that are just downright lovely. While a PostScript drawing program like Illustrator can create



#### THE FACTS

Illustrator 88 \$495

Requirements:

A Macintosh Plus

A Macintosh Plus with an 800K-byte external hard disk drive and System 4.2 or higher.

Adobe Systems 1585 Charleston Rd. P.O. Box 7900 Mountain View, CA 94039 (415) 961-4400 Inquiry 852.

superb engineering-type artwork quickly—it's perfect for schematics, diagrams, and models—the addition of color capabilities makes it suitable for softer, nontechnical work as well.

One of FreeHand's nice effects is its shading capabilities, which let you fill an image with graduated color or intensity. Illustrator 88 has a tool that produces similar results, but it is considerably harder to use. In fact, I found this Blend tool to be the most

frustrating part of the program.

You'd better have a real good grip on Illustrator's main elements (i.e., paths, endpoints, and anchor points) and terminology before you tackle blending. I made the mistake of just trying to feel my way through the process of blending two different shapes and kept getting hit with error messages like "Please use the Blend tool on a selected endpoint of an ungrouped open path." This is not MacPaint. You can't just pick up a brush

and go to work. Save yourself lots of time and frustration by reading the manual.

Illustrator has not improved much in its text tools. You can do some fancy things with characters and fonts—like changing their shapes and filling them with patterns—but you can't mix fonts or sizes within a chunk of text. And some users have criticized the program's lack of kerning control.

While Illustrator 88's preview mode is handy, you can't do any work to the drawing on the screen. You have to switch back to the raw version to make any changes. It took me a while to stop instinctively trying to edit the drawing in preview mode, which is something it is possible to do in FreeHand.

One thing to know before getting into Illustrator is the oodles of memory it can use. You have to pay something for the power of this program, but on a 1-megabyte machine, which is the minimum, you don't have much room to work with.

Criticizing Illustrator 88 is a bit like criticizing Brooks Robinson as a third baseman. How can you argue with something that gets the job done and done gracefully? As for the contest between Illustrator and FreeHand, I'd say Adobe has tied the score, maybe even gone ahead.

-D. Elvis Barker

#### Listen While You Work: Apple's CD-ROM Drive

The AppleCD SC CD-ROM drive gives Macintosh and Apple II users access to applications containing up to 550 megabytes—and the chance to listen to music while working with all that data. Since the CD-ROM drive uses the small-computer-systeminterface (SCSI) port to connect to the computer, hooking it up is trivial. Just connect a SCSI cable (\$50 at Apple's prices) between the Mac and the AppleCD SC. If it's the

only SCSI device on the system, install the SCSI terminator plug (\$30) and the Apple-CD SC is ready for action. You also need to install the CD-ROM drive software driver, which lets the system recognize the AppleCD SC.

Unfortunately, while I was testing the drive, most CD-ROM software developers had not yet released their products. By the time you read this, however, several CD-ROM applications should be avail-

able, and more vendors are expected to announce products for the AppleCD SC this fall and early next year.

I had to content myself with Apple's "learning disc," which presents a number of third-party applications currently under development, all running under HyperCard 1.2 (HyperCard 1.1 does not support the AppleCD SC). These applications to come include Grolier's New Electronic En-



Embedded systems designers have already used CrossCode C in over 172 different applications.

## **Introducing CrossCode C** for the 68000 Microprocessor Family

#### Finally, a 68000 C Compiler that's tailor-made for ROMable applications

rossCode C is designed *specifically* to help you write ROMable code for all members of the Motorola 68000 family.

#### A ROMable C Compiler?

To get truly ROMable code, you have to start with a truly ROMable compiler. Here are three CrossCode C features that you won't find in any ordinary C compiler:

- · Compiler output code is split into five independent memory sections that you can assign into ROM or RAM as you please.
- You can optimize the code for your application because you control the sizes of data types. For example, you can optimize for speed by using two byte ints, or get maximum versatility by using four byte ints.
- You can easily write assembly language routines that call C functions and viceversa, because the compiler uses simple, well documented parameter passing conventions.

#### **How About Low Level Control?**

CrossCode C comes with an assembler that has all the features that assembly language programmers require. In fact, you could write

your whole application with it:

- · The assembler features an advanced macro language, conditional assembly, "include" files, and an unlimited size symbol table.
- Detailed cross references show you where you've defined and referenced your symbols.
- · After a link, you can actually convert your "relocatable" assembler listings into "absolute" listings that contain absolute addresses and fully linked object code.

#### Can It Handle The Link?

The CrossCode C linker is designed to handle truly huge loads. There are no limits on the number of symbols in your load or on the size of your output file. And you can always count on full 32 bit target addressability, because the linker operates comfortably in the highest ranges of the 68020's address space.

#### How Does It Get To ROM?

CrossCode C comes with a downloader that puts you in touch with all EPROM programmers and emulators. It can convert your load into Motorola S-Records, Intel Hex, Tek Hex, Extended Tek Hex, and Data I/O ASCII Hex. You can also produce a binary image and convert that image into any format you might want. In all formats, bytes can be split into EPROMs for an 8, 16, or 32 bit data bus.

#### Why Wait?

Once you start using CrossCode C, you may just wonder how you ever got the job done before! It's available under MS-DOS for just \$1595, and it runs on all IBM PCs and compatibles (640K memory and hard disk are required). Also available under UNIX & XENIX.

**CALL TODAY** for more information:

#### 1-800-448-7733

Inside Illinois or outside the United States, please dial

> PHONE: 1-312-971-8170 FAX: 1-312-971-8513

SOFTWARE DEVELOPMENT SYSTEMS, INC. 3110 WOODCREEK DRIVE DOWNERS GROVE, ILLINOIS 60515 USA

CrossCode™ is a trademark of SOFTWARE DEVELOPMENT SYSTEMS, INC. MS-DOS® is a registered trademark of Microsoft. UNIX® is a registered trademark of AT&T. XENIX® is a registered trademark of Microsoft.

#### **Quality Was Never Priced So Low!**

2400 bps 2400 / 1200 / 300 bps

#### 5 Year Parts and Labor Warranty

Our 2400HC<sup>2</sup> Hayes Compatible Half Card modem is for IBM PC/XT/AT and compatible computers. It uses the standard 'AT' command set. Included with our modem we supply communications software, a 7 foot cord and documentation.

We build our modems at a mil-spec board house located in suburban Chicago, using quality components. We test every modem shipped and back our confidence in our quality with a 5 year parts and labor warranty from the factory and a 30 day money back guarantee.

Engineering Inc.

162 N. Franklin St. • 5th Floor • Chicago, IL 60606 Toll Free Order Line for orders only 1-800-442-2285 For orders in Illinois 1-312-358-1501 Kiss Engineering Technical Support 1-800-442-2285 Orders within the USA (including Alaska & Hawaii) are shipped FREE via UPS.

Payment in U.S. funds drawn on a U.S. bank required. COD orders placed before 2 pm CST shipped same day. Illinois residents add 8% sales tax We do not accept credit cards Please send check or money order for \$100.

#### Subscription Problems?



#### We want to help!

If you have a problem with your BYTE subscription, write us with the details. We'll do our best to set it right. But we must have the name, address, and zip of the subscription (new and old address, if it's a change of address). If the problem involves a payment, be sure to include copies of the credit card statement, or front and back of cancelled checks. Include a "business hours" phone number if possible.

#### RUTE

Subscriber Service P.O. Box 7643 Teaneck, NJ 07666-9866

#### THE FACTS

AppleCD SC \$1199

Requirements: Apple Macintosh or Apple II with a SCSI cable; HyperCard 1.2 recommended for use on the Macintosh.

Apple Computer 20525 Mariani Ave. Cupertino, CA 95014 (408) 996-1010 Inquiry 853.

cyclopedia, Stanford University's The Electric Cadaver for studying human anatomy (see the August Microbytes), and samples from The Whole Earth Catalog. Most of the sample applications include lots of graphics and sound and are an impressive demonstration of the potential of the CD-ROM.

Accessing the drive through HyperCard is no different from accessing a HyperCard stack on a floppy disk or a hard disk. The drive appears as an icon on the desktop, and you can open it just like any other folder or stack. The main difference, of course, is that you can't write to the CD-ROM drive or make any changes to the data that's on the disk.

While HyperCard will probably be the main interface for CD-ROM software on the Macintosh, Apple will provide support for the High Sierra ISO disk format, which is dominant in the CD-ROM industry. When the High Sierra system software is available, you can get it by mailing Apple a coupon that comes with the AppleCD SC. (High Sierra will be supported on both the Macintosh and Apple II, Apple says.)

A slick feature of the Apple-CD SC is its ability to play standard audio compact disks using a desk accessory called CD Remote, which controls the audio disk. The CD-ROM drive has sockets for connecting earphones, stereo speakers, or a stereo amplifier. To use the AppleCD SC as a stereo system, simply click on CD Remote and insert an audio disk in the drive. CD Remote presents a panel on the screen, where you can click on various buttons to play certain selections, switch tracks, pause, repeat, and so forth. You can also remove the panel from the screen and the CD will continue to play as a background task.

The AppleCD SC drive is an excellent product, but it's pretty expensive at \$1199 (add another \$80 for cabling). The biggest disappointment is the lack of software at this time. Unless there's an application out there that you've got to have right now, it's probably best to wait until more software is available.

-Nick Baran

#### Two Great Caching **Programs**

s processors get faster and faster, disk I/O becomes more and more of a bottleneck. A few major manufacturers (notably, IBM and Compaq) package disk-caching software with their systems to speed up read/write operations.

A disk cache selectively buffers disk reads and writes. substituting fast RAM accesses for unnecessary or repetitious—and slow—disk operations. A cache offers many of the speed benefits of a RAM disk but is easier to use. And it's also safer, because a cache will automatically "write through" to the disk instead of requiring an explicit save or copy command.

I looked at two inexpensive disk-caching programs that widen the bottleneck by speeding up input and output: Multisoft's Super PC-Kwik and Polytron's PolyBoost II. Both offer blazing speed and impressive bells and whistles.



"More Powerful

**BLACKOUTS** Enables user to operate during complete loss of power.

BROWNOUTS User is protected from low AC voltage below 102 volts.

**OVERLOADS** Automatic shutdown in overload situation to protect UPS from inverter burnout.

**OVERVOLTAGE** UPS runs on inverter (117 volts) when AC voltage exceeds 132 volts.

**SURGES/SPIKES** Clamps transients above 200 volts with an energy rating of 100 joules or less.

EMI/RFI Three stage filtering for clean AC power.

- FULL ONE YEAR WARRANTY
- ORDER-SHIP SAME DAY
- 1 MILLISECOND TRANSFER TIME\*
- SYNCHRONIZED SINEWAVE\*

\*250 watt and 500 watt units offer 4 msec transfer time, PWM waveform



1455 LeMay Dr. Carrollton, TX 75007



Telephone: (214) 446-7363

1-800-238-7272

FAX: (214) 446-9011

Power Output	120 Volt Models	230 Volt Models
250 WATT	\$ 379.00	\$ 429.00
300 WATT	\$ 549.00	N/A
500 WATT	\$ 699.00	\$ 799.00
600 WATT	\$ 899.00	\$1049.00
1200 WATT	\$1499.00	\$1749.00
1600 WATT	\$1999.00	\$2299.00

Suggested Retail

omdex/Fall '88 Convention Center **Booth #163** 





#### Compact Disk Products, Inc. ALL PRODUCTS, LOWEST PRICES, EXPERT ADVICE INTRODUCTORY OFFERS Hitachi 1503S or 3500S CD-ROM Drive with your choice of: McGraw Hill Science and Technical Reference Set . . . . \$895 \$995 \$895 \$895 CD-ROM SOFTWARE Oxford English Dictionary Comstock Stock Photography On CD Educorp Public Domain/Shareware for the Mac The New Grolier Electronic Encyclopedia McGraw Hill or Bookshelf or PGSIG NEW . \$945 \$445 \$249 \$359 \$269 \$495 \$845 Geovision U.S. Atlas and Mapmaker \$795 TOLL FREE ORDER LINE · 800-MEGABYTe (634-2298) CD-ROM and WORM DRIVES Hitachi 1503S External CD-RDM Drive with Audio . . . . . \$729 1503S with Digital Audio Output . . . \$1229 \$3799 \$2799 \$3795 CD-Play (\$89) Pop-up utility that permits user to play all audio COs on Hitachi and compatible drives. Output to headphones or amplifier. CD-Play+Sampler (1948) Same features as DJ-Play plus the shifty to name two points on an audio CD and loop between them. CD-AudioFile (1948) Automatically creates database records of all your audio CDs. Allows you to store a preferred play sequence for each disk. Automatic recognition of CDs. Creates DBase compatible records. Compact Disk Products [ 217 E. 85th St. New York, NY 10028 Tel. 212-737-8400 Fax 212-439-9708 Compuserve 75530,214 Free 3 Month Subscription to CD-ROM Review with orders over \$300 INTERNATIONAL ORDERS A SPECIALTY Australian Agent: KEWTEL 145 Cotham Ad. Kew, Victoria 3101 Tel. (03) 817-5933



#### THE FACTS

Super PC-Kwik \$79.95

Multisoft Corp. 15100 Southwest Koll Pkwy., Suite L Beaverton, OR 97006 (503) 644-5644 Inquiry 854.

PolyBoost II \$79.95

Polytron Corp. 1700 Northwest 167th Pl. Beaverton, OR 97006 (503) 645-1150 Inquiry 855.

Requirements for both: IBM PC, XT, AT, PS/2, or compatible with DOS 2.0 or higher, 5K bytes to 5 megabytes free memory (conventional, extended, or expanded), and a hard disk drive.

Both will accelerate the disk I/O of almost any Intel-based machine, and both can exploit conventional, extended, or expanded memory; users of IBM PC AT-class machines also can put to use the top 384K bytes on their 1-megabyte motherboards without the Lotus/Intel/Microsoft Expanded Memory Specification or any other memoryenhancing scheme.

I tried both caches on a 16-MHz Compag 386 with 2 megabytes of memory and on a 16-MHz Club American 386 with 1 megabyte of memory. Both programs worked flawlessly and boosted disk throughput from 3 to 7 times that of the same machines without caches. (For workaday applications, a speed increase of 3 or 4 times is typical.) I found that both programs were faster than the caching program Compaq supplied; I've stopped using Compag's cache.

While both caches are fast, PolyBoost II is marginally faster than Super PC-Kwik. For example, a read/writeintensive operation like decompressing a series of archived text files took 22 seconds with PolyBoost II installed and 24 seconds with Super PC-Kwik installed. (With no cache, the decompression took 39 seconds.)

A few seconds here or there won't add up to early retirement, but if speed is the determining factor (it is for me),

PolyBoost II is the better choice. On the other hand, because their performances are close, the bells and whistles each of these programs offer may tilt the balance one way or

the other for you.

Super PC-Kwik has a mindboggling array of options to optimize its operations for your usage patterns. It also runs cooperatively with Multisoft's versatile PC-Kwik Print Spooler (sold separately for \$45): The two programs can dynamically share the same memory above 640K bytes. It's pretty slick. In effect, it uses the same RAM to preferentially buffer and accelerate whatever the current slowest I/O operation is.

PolyBoost II takes a different tack: It's actually a suite of several programs, including a cache, a keyboard enhancer (which speeds up keyboard response and includes a command-line editor), a screen speedup program (for monochrome or color displays), a disk unfragmenter, and several other utilities. The combination of disk, keyboard, and screen speedups that results when using PolyBoost II is impressive enough to make your computer feel like a new and much faster animal.

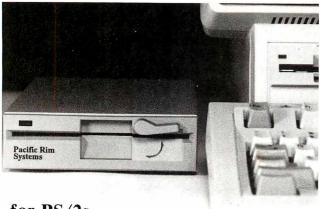
Any cache is better than no cache; and these caches are better than some others. You really can't go wrong with either.

> -Fred Langa continued

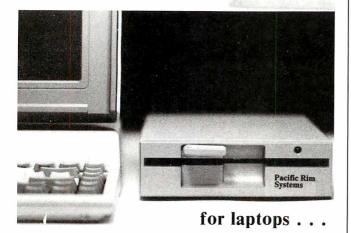


# Thy do institutions worldwide trust ARC? Before you purchase your next computer, call us. You owe it to yourself to find out.





for PS/2s...



#### End 3½ Inch Frustration

Complete solutions for using 51/4" diskettes on your 31/2" based computer.

Our solutions for IBM® PS/2® computers are available in either 1.2MB or 360KB varieties, ending frustrations for all media standards. Both are **complete** with everything needed for any model PS/2 in a single box. No power supply, no adapter board, and we don't waste an expansion slot.

Our laptop solutions also offer "one-drive-fitsall" convenience. Simply order the cable for the computer of your choice. All popular laptops are supported.

Customized versions available for special applications. Domestic and international resellers welcome.

51/4" Subsystem Specialists

#### Pacific Rim Systems, Inc.

2570 Barrington Court Hayward, California 94545 FAX: (415) 782-1017 Telephone: (415) 782-1013

### A Personal Tickler That Runs under OS/2

espite having to keep track of such things as meetings, deadlines, and my wife's birthday, I've frankly found today's crop of memory-resident personal schedulers a real pain. I don't have the time to learn them, and they take up huge chunks of my limited MS-DOS RAM real estate. So, with all this computing "power" on my desk, I still use pocket- and desk-size calendars to schedule my days.

But that may change pretty darn fast. Tickler/2 is by far the most powerful personal scheduler I've seen. It has a bunch of handy features and tricks, a simply elegant user interface, and a low price, and it runs only under OS/2.

Tickler/2 is the electronic equivalent of those famous paper-based tickler files that many disgustingly organized people use. A classic tickler file takes up loads of space by using individual file folders. one for each day in the month, along with folders for individual months and upcoming years. You fill these folders with pieces of paper: notes, reminders, letters to follow up, and so on. It can get absurdly crowded and confusing, and you're up the creek if you mis-

#### THE FACTS

Tickler/2 \$80

Requirements: IBM PC AT, PS/2, or compatible with OS/2 Standard Edition 1.0 or higher and a hard disk drive.

Enyart Development Corp. 7000 East 70th Ave. Commerce City, CO 80022 (303) 286-8686 Inquiry 856. file an important paper.

This program uses OS/2's extended memory capacity and multitasking abilities to offer a huge amount of options. Besides the normal chore of entering appointments, you can set messages to appear on your screen at just about any interval or on any date, even years in advance. It also has a relative scheduling feature that lets you enter a major event and then indicate when and how often you want to be reminded of it. If you tell it to be merciless, Tickler/2's "nag" feature will continually remind you of something you need to get done until you indicate you've done it. It will also count down the days (or hours) until deadline. Features like this are just the thing for foot-dragging editors who put off writing Short Takes until the last minute.

Tickler/2 also lets you attach OS/2 commands to a message. With this feature, you can have Tickler/2 do things like automatically sending a monthly report to the boss or performing a weekly hard disk backup. I used it to automatically log on to BIX overnight, get my electronic mail, and file conference messages. Sure, you can do this with several MS-DOS programs, but the fact that it's integrated with Tickler/2's other features makes it handy indeed.

But the most intriguing feature is something that is called a "named event." You can attach a virtually unlimited list of messages to an event that you can't pin down to one particular time. For example, if you sell computers, you can enter messages that are set to start every time a customer buys a system, doing things like sending a thank-you letter, service reminders, and even a "trade-in time" reminder a few years in the future.

#### 3 books for only \$1.95

#### and get FREE The Handbook of Computers and Computing

Values to \$219.80 \$

Society.

YES! Please accept my membership in the Computer Professionals' Book Society and send me the volumes I have listed below plus my free Handbook of Computers and Computing (9785H), billing me only \$1.95 plus shipping and handling charges. I understand that the books are sent on

a 10-Day Free Examination basis. If dissatisfied in any way, I may return the books within 10 days and incur no further obligation. Otherwise, I agree to pay the enclosed invoice promptly and to receive regular club bulletins as described in "How the Club Works." To complete my membership obligation I need only purchase 3 additional books at regular members prices during the next 2 years, and may resign at any time thereafter.

NAME		
ADDRESS		
CITY	STATE/ZIP	
BIGNATURE	F	

Computer Professionals'
Book Society

must remit in U.S. funds. This order is subject to acceptance by the Computer Professionals' Book

#### 3 books for only \$1.95

#### and get FREE The Handbook of Computers and Computing

Values to \$219.80 \$

YES! Please accept my membership in the Computer Professionals' Book Society and send me the volumes I have listed below plus my free Handbook of Computers and Computing (9785H), billing me only \$1.95 plus shipping and handling charges. I understand that the books are sent on

a 10-Day Free Examination basis. If dissatisfied in any way, I may return the books within 10 days and incur no further obligation. Otherwise, I agree to pay the enclosed invoice promptly and to receive regular club bulletins as described in "How the Club Works." To complete my membership obligation I need only purchase 3 additional books at regular members prices during during the next 2 years, and may resign at any time thereafter.

STATE/ZIP	
applicants will receive special ordering subject to acceptance by the Computer to the computer of the computer	
	STATE/ZIP  pplicants will receive special ordering

### Computer Professionals' Book Society



NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

# **BUSINESS REPLY MAIL**

FIRST CLASS PERMIT NO. 9 BLUE RIDGE SUMMIT, PA 17214

# POSTAGE WILL BE PAID BY ADDRESSEE Computer Professionals' Book Society Blue Ridge Summit, PA 17214-9988



NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

# **BUSINESS REPLY MAIL**

BLUE RIDGE SUMMIT, PA 17214 PERMIT NO. 9 FIRST CLASS

POSTAGE WILL BE PAID BY ADDRESSEE

# Computer Professionals' Book Society

Blue Ridge Summit, PA 17214-9988



#### THE COMPUTER PROFESSIONALS' BOOK SOCIETY

The easy, reliable way to satisfy your professional book needs.

## Take 3 books for only \$195

Values to  $^{ackprime}$ 

#### and get The Handbook of Computers and Computing FREE!











3098 \$44.50 Counts as 2

9808P \$34.95

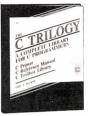
3028 \$25.95



9760 \$17.95









2951P \$17.95

9777 \$49.95

2856P \$18.95

9786 \$32.95

2937 \$29.95

2890 \$32.95

9779P \$22.95





2838 \$19.95





Computing

9136 \$34.95



2916P \$19.95



2763 \$27.50



9832 \$36.95



9815 \$38.95



3019 \$39.95







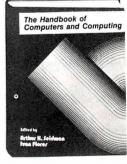
9812 \$38.95



and Ivan Flores Featuring 50 original articles by leading computer experts, this professional sourcebook delivers the essentials you need in both

hardware and software areas. 874 pp.

(a \$79.95 value)



How the Club Works

YOUR BENEFITS: You get 3 books for \$1.95 plus shipping & handling when you join. You keep on saving with discounts from 20 to 50% as a member.

YOUR PROFESSIONAL BOOKSTORE BY MAIL: Every 3-4 weeks, you will receive the Computer Professionals' Book Society News describing the Main Selection and Alternates, as well as bonus offers and special sales, with hundreds of titles to choose from

AUTOMATIC ORDER: If you want the Main selection, do nothing and it will be sent to you automatically. If you prefer another selection, or no selection at all, simply indicate your choice on the reply form provided. As a member, you agree to purchase at least 3 books within the next 2 years and may resign at any time thereafter.

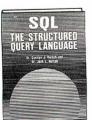
BONUS BOOKS: Starting immediately you will be eligible for our Bonus Book Plan with

savings of up to 80% off publishers' prices. IRONCLAD NO-RISK GUARANTEE: If not satisfied with your books, return them within 10 days without obligation!

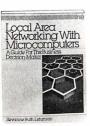
EXCEPTIONAL QUALITY: All books are quality publishers' editions especially selected

by our Editorial Board. All books are hardcover unless number is followed by a "P" for paperback. (Publishers' Prices shown)

© Computer Professionals' Book Society, Blue Ridge Summit, PA 17294-0870



3016 \$24.95



9824 \$49.95

9763P



Circle 63 on Reader Service Card

#### A Message To OUR SUBSCRIBERS

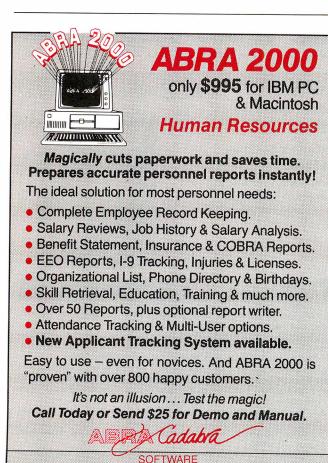
F ROM TIME TO TIME WE MAKE THE BYTE subscriber list available to the subscriber list available to t subscriber list available to other companies who wish to send our subscribers material about their products. We take great care to screen these companies, choosing only those who are reputable, and whose products, services, or information we feel would be of interest to you. Direct mail is an efficient medium for presenting the latest personal computer goods and services to our subscribers.

Many BYTE subscribers appreciate this controlled use of our mailing list, and look forward to finding information of interest to them in the mail. Used are our subscribers' names and addresses only (no other information we may have is ever given).

While we believe the distribution of this information is of benefit to our subscribers, we firmly respect the wishes of any subscriber who does not want to receive such promotional literature. Should you wish to restrict the use of your name, simply send your request to the following address.

BYTE MAGAZINE

ATTN: SUBSCRIBER SERVICE P.O. Box 7643 TEANECK, NJ 07666-9866



5510 - 9th Street North, St. Petersburg, FL 33703 (813) 525-4400

Tickler/2 is actually made up of two programs: There's a foreground editor/database for entering your messages and schedule, and a 36K-byte program runs as a detached task under OS/2. The latter triggers the reminder messages. And since it's OS/2, there's no "RAM cram" or ill-behaved terminate-andstay resident programs.

Tickler/2 is one of the easiest-to-use programs I've seen. You don't have to learn esoteric syntax to enter messages and times; in most cases, you just have to type a few keystrokes and highlight a date or time using the cursor keys.

-Stan Miastkowski

#### Zortech's Comm Kit

ortech's Comm Toolkit Z ortecn's Committee package is an eye-opening collection of programs geared to the programmer involved with serial-port communications and anxious to get on with it. Here you'll find functions that cover the entire range of communications complexities: from rudimentary "send-a-byte-out-theserial-port" to a single function that implements batch Kermit-protocol transfers. Zortech provides source code compatible with Microsoft C (Quick C), Turbo C, and (understandably) the Zortech C compiler. If your favorite compiler isn't on that list, you can modify the source code so your own compiler will not have an immune reaction.

That's right, Zortech provides the complete source code, right down to the lowlevel library routines.

If you're going to do any kind of terminal emulation, you're going to need to deal with screen-driver software. Here's where Comm Toolkit scores again. You'll find definitions for a standard display as well as a Windows driver. Also, Zortech includes source code for ANSI, VT-52, and VT-100 emulators.

I linked my XT clone and my AT clone and decided to test Minicom and Maxicom. the two communications programs in the package. I put the Zortech programs on one end and HyperAccess on the other. Zortech's programs had trouble on my Xitses (the MCT-IO multiserial board from JDR Microdevices), but they seemed to do better when I tried them on the AT clone with a stock IBM serial card. Even then, when I changed the data transfer rate from the menu in Maxicom, the system stopped receiving (though, mysteriously, it could transmit).

When things worked, I ran XMODEM and Kermit transfers in both directions up to 9600 bits per second with modest throughput. I attribute the program's unimpressive speed to the fact that the XMODEM and Kermit code appear to do no explicit record buffering and therefore suffer from frequent disk accesses.

I have mixed feelings about the Zortech Comm Toolkit. If the bugs get cleaned out. there's certainly plenty of usable code here. You might need to do some work to get the code compatible with your serial interface—particularly if you're using a nonstandard clone board. But if you've got some communicating to do and don't mind a little lowlevel programming, you ought to check it out.

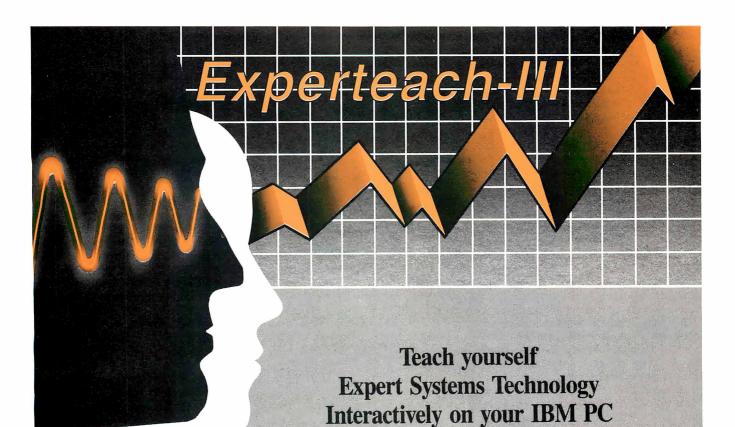
-Rick Grehan ■

#### THE FACTS

Zortech Comm Toolkit \$49.95

Requirements: IBM PC or compatible with Microsoft Quick C, Borland Turbo C, or the Zortech C compiler; DOS 2.0 or higher.

Zortech, Inc. 361 Massachusetts Ave. Arlington, MA 02174 (617) 646-6703 Inquiry 857.



#### Experteach-III Includes:

- · The Structure of Expert Systems.
- · Inference, Forward and Backward Chaining.
- · Inexact Reasoning.
- · Frames and Inheritance.
- · Intelligent Database Systems.
- · Knowledge Acquisition.
- · Knowledge Representation.
- · Building Expert Systems.
- · Automatic Knowledge Acquisition Systems.
- · Machine Learning and Induction.
- Expert System Verification.
- · Case Studies of Expert Systems.
- · Use of Conventional Languages.
- · Source Code in C and Pascal.

#### Intelligence Ware, Inc.

Leading in Artificial Intelligence Applications Experteach-III and IntelligenceWare are trademar Inc. IBM PC is a trademark of IBM Corporation

Experteach-III is a comprehensive guide to Expert System Technology consisting of a uniquely integrated collection of Expert System tutorials, case studies, and interactive on-line teaching programs.

You are introduced to Expert Systems technology with easy to understand text and interactive tutorials allowing you to test your comprehension of the concepts presented. Experteach-III draws its power from the uniform integration of Expert System concepts and provides you with a broad and overall view of the Expert System field.

A clearly written tutorial text is included along with well designed on-line interactive tutorials. Together, they provide a concise exposition of Expert Systems technology. Experteach-III graphically explains concepts such as forward and backward chaining, pattern matching, backtracking, conflict resolution, inexact reasoning, frames and inheritance, object oriented programming, etc. These concepts are explained in a step-wise, easy to understand manner.

Experteach-III provides an in-depth understanding of the inner structure of Expert Systems technology.

Experteach-III is based on extensive experience in teaching Expert System concepts in associaion with IEEE, ACM, UCLA, and the Continuing **Education Institute.** 

with this Comprehensive

**On-line Study Course** 

intelligenceware, thc. 9800 S. Sepulveda Blvd., Suite 730 Los Angeles, CA 90045 (213) 417-8896
☐ I don't want to let technology pass me by!  Send copies of Expertech-III at \$129 each.
Check or money order payable to IntelligenceWare, Inc. is enclosed.
☐ Charge my ☐ Visa ☐ MC ☐ AMX No Exp. Date
Shipping and handling, US: \$5, Canada and
Hawaii Air: \$15, Overseas Air: \$25.
CA residents please add 6.5% sales tax.
☐ Send me information on other IntelligenceWare Products.
Name
Company
Address
Tel. No Ext
Signature

or PC/AT 512K memory

# Train Your PC to Read...

APARATIVE RULE

-\$1,220

\$2,430 \$14,930 \$23,430

\$45,930

discussed.

Jerry Pourielle holds a doctorate in psy-chology and is a science fiction writer no about commune morable living writer morable living writer

-\$8,720

9.00 plus 15% 224.00 plus 28% 652.00 plus 35%

377.00 plus 38.5%

That is, to regard them as a means to intimidate and the contract that the contract them to intimidate them. But the contract the contract them are contract them. But the employees rather than encourage them, but the

demptation to ao inis can be overcome by seit-examination—how do fou as an employee respond

coded alligator clips. I'd carried it to many places, but I'd never been desperance in the control of the contr

Observation: There is an obviously selfdefeating way to look at Potential Interview of the mass a means to intimidate encourage them. But the

...the Same Things You Read! with graduated inches on the back.

Flagstaff Engineering's optical character recognition software reads almost any printed or typewritten text.

SPOT,\* our trainable OCR program, allows you to compile information from books, magazines, typewritten records, genealogical data, directories, catalogs, and public documents, including foreignlanguage material. The data captured by SPOT can be used by database, word processing, desktop publishing and typesetting applications.

SPOT's flexible output options allow you to preserve the original page format, including columns and margins. Reformatting options include the choice of DCA or ASCII output files, with options to generate singlecolumn output from multiple-column text.

#### Features:

GAEBEL NG31 AD AGENCY BULE

\$165.00 plus 15%

\$2,040,00 plus 28% \$4,420.00 plus 35%

another von need to discuss it to decision can get you into trouble, The covered contin When you need to discuss it wi

that have to be covered, contint

Straight answer: Tell the perso

\$12,295,00 plus 38,596 \$45,930

A 1%" X 18" Iwo-sided metal ruler with Inches, picas, and 10 points and 10 points and

High recognition accuracy

\$930

\$2,430

-\$14,930

- Fast, easy training
- Up to five fonts per page
- Handles ligatures and kerned type
- Foreign language character sets
- Spelling and context checking
- On-line correction
- Affordable at \$995.00

Flagstaff Engineering leads the PC industry in desktop conversion systems for 9-track tape and 8-inch diskette data files. We have already supplied thousands of customers worldwide with our OCR systems. Call for the best prices on Panasonic, Hewlett-Packard, and Canon scanners. Dealer and volume discounts are

Flagstaff Engineering can modify the software code to meet your custom applications. For details, call us at (602)779-3341.

\*Syntactic Pattern Optical Translator

Come see us at COMDEX Booth #C107 1120 Kaibab Lane • Flagstaff, AZ 86001 (602)779-3341 • Telex 705609 • FAX (602)779-5998

Circle 95 on Reader Service Card (DEALERS: 96)



## STICK SHIFT OR AUTOMATIC?

Jerry takes a look at the new version of Windows and delves into the history and functionality of Sprint

he other day, Mrs. Pournelle and I were walking in the hills behind Chaos Manor. When we came down into the back-road area, we saw a young man trying to teach his girlfriend to drive. "That's the real test," Roberta said. "Teaching her to drive, or teaching her to use a computer, it's the real test of true love.'

"Stick shift car, too," I said. She shrugged. "All computers are stick shift.'

I've been thinking about that.

Of course, the Macintosh tries to get away from the "stick shift" image, and it has a lot of converts. My youngest boy enters college this fall. He has a Mac Plus. One of his older brothers wants to trade his IBM PC AT for a Mac. Both claim they're not interested in learning about computers, they just want to use them. I remember saying something like that back when I began this column more years ago than I want to admit. My friend and colleague Tom Clancy does all his work on a Mac and isn't vaguely interested in learning about PCs. Perhaps it's valid to think of the Mac as the first automatic shift machine.

If so, then the PC world is beginning to breathe down the Mac's neck.

#### Windows

I suppose I have to be careful what I say, lest I get myself involved in Apple's silly lawsuit against Microsoft and Hewlett-Packard; but I've just come back from a Microsoft-sponsored Windows exposition, and I can only conclude that Windows is hastening the process of the "Macintoshization" of the PC. If you prefer to say that Windows is now implementing many of the ideas developed at Xerox's Palo Alto Research Center (PARC) lo these many years ago, then partly perfected by Niklaus Wirth, and finally popularized by Apple's Macintosh, feel free. The point is that Windows consciously attempts to make the PC an automatic shift computer.

Of course, automatic shifts need cars that are higher-powered. Same with computers. If you have an ordinary PC or XT, I don't recommend Windows. If you want multiple applications-sort of like the Macintosh MultiFinder-and you have an XT with a hard disk drive and a good bit of RAM disk as well, DESQview is marginally better than nothing. Windows isn't for you; it's just too slow. I don't really recommend either for slow machines.

If you have an AT, you have more choices. Windows/286 is Microsoft's newest. It isn't very good at taking ordinary DOS programs and running them in the Windows environment. Still, Windows/286 version 2.10 is a distinct improvement over the older Windows, and it's not all that bad. Windows/286 can run DOS stuff, provided that your AT computer is fairly vanilla, the program isn't too badly behaved, and you hold your mouth right; but it will be slow, even if you've got a fast system. If all you want to do is run standard DOS programs, you'll probably be better off with DESQview.

Windows/386 is better yet. Windows/ 386 on an 80386 machine is better than DESOview on an 80286 machine. On the other hand, DESQview works spectacularly better on an 80386 than it does on an 80286; and Windows/386 is still slower than I like. There is room for a difference of opinion. People I respect like Windows/386 a lot. It certainly is usable, if slow.

Windows/386 isn't easy to install. It

doesn't like a number of EGA cards (Orchid and Paradise seem to be all right). The Setup program takes quite a long time, and if you have to make any changes in your installation, you must start all over again. This can be quite annoying.

When you're installing Windows/386, I advise you to throw away your AUTO-EXEC.BAT and CONFIG.SYS files. Windows/386 will construct new ones. Let it. Don't set up any buffers, or environment, or paths, or anything else while you're trying to get Windows/386 going. Then, when you have Windows/386 up and running, you can tweak the start-up files to see what you can get away with.

You want to be real careful about what DOS you're running, too; I'm still getting DOS version incompatibility errors in Windows/386 long after I thought I'd eliminated all possible sources of such errors. I still don't understand that; it could be that I've added something odd to my CONFIG.SYS file or tried to use DOS extensions for the CD-ROM reader.

If you have a very vanilla system and don't use networking, running ordinary programs under Windows does have some advantages. Windows has convenient features, like its own pop-up notebook and calculator (but no calendar), and it does make switching from one program to another a lot easier (although not easier than DESQview). Where Windows-/286 or /386-really shines, though, is running programs developed especially for use with Windows. Some of those work spectacularly well. The Windows screens are laid out well and are as easy to understand as any Mac screen. Windows screens are more customizable, too.

I'm just beginning to collect software that's been specially adapted to work with Windows. Most of it, like Microsoft Excel and MacInTax PC, comes with a run-time package so that you don't really need Windows; but it's much better if

you have Windows and are familiar with it. Windows/386 running programs adapted for Windows runs like lightning, and it does all the things the Macintosh MultiFinder is supposed to do but hasn't quite perfected.

When I'm using Windows to run programs like Excel and MacInTax, I understand why Apple was so terrified of Windows that they brought in the lawyers. The interface is at least as good as Apple's; indeed, many will think Windows does the integration of mouse and keyboard better than the Macintosh does. The various operations are smooth and intuitive. Better yet, you don't give anything up; you can still use DOS with its wild-card commands.

We did notice that, probably because of the lawsuit, Windows no longer has "TRASH" as the place to put deleted files. The legend under the icon (which doesn't look like Apple's Trash) now says "GARBAGE." Roberta suggested they have an icon of the kitchen sink and label it "DISPOSALL," which inspired me to think up a large vortex with the label "BLACK HOLE." Apparently, Apple is adamant about owning the Trash, and nearly everyone is willing to let Apple have it if they want it so bad.

We made that suggestion at the Hewlett-Packard booth at the Windows show. Hewlett-Packard has a Windows adaptation called NewWave. The demonstrator chuckled and called in the icon editor. Within a couple of minutes, he had a kitchen sink labeled "DISPOSALL," and he was starting in on the "BLACK HOLE." I didn't get much chance to look at NewWave, but from what I did see, I was impressed.

I wasn't much of a Windows fan when the program was first introduced, but I can see how I might become one if they can get enough programs adapted for it. Windows doesn't yet do much with devices like CD-ROM drives—Microsoft Bookshelf is a pain to get going in the same window with your word processor, but then it's a pain to get DESQview to handle it, too.

Microsoft tells software developers that the best way to learn to write software for OS/2 and Presentation Manager is to begin with Windows. From what I've seen, if you're developing new software, you might want to seriously consider adapting your stuff for Windows, no matter what you think of OS/2.

They are going to have to speed things up, though. I suspect the way to do that will be with faster video boards. Most of the wait comes from having Windows draw stuff on your screen.

Windows hasn't yet got us out of the stick shift era, but it looks like the next revision just may do it.

#### Actor

One program that has been adapted for Windows is the Actor language. This is one of the family of languages that includes Smalltalk: you have data classes, and you send messages to them; then they do things, like make new windows with certain features, or put images on the screen, or do calculations. Actor is interactive and compiles as you write it, producing threaded code like Forth; but it's said to be a great deal easier to learn, and to use, than Forth.

I don't know. My only exposure to Actor was in a demonstration at the Windows seminar. I was impressed, but then one is often impressed by demonstrations; the acid test will be to see if I can write programs with it when I get it here. I will say that it sure looked like it understood how to interact with Windows; I watched them create several small programs to my specifications, and it seemed like child's play. More when I know more, but my first impression is that Actor and Windows may be made for each other. If you're a language collector or if you're seriously interested in Windows, take a look at Actor.

#### Special Days and Footprints in History

An outfit called The Salinon Corporation has a series of programs called the "Life and Times" series. One program is called Special Days: you put in data, say someone's name, birthplace, and birthdate. The program looks things up in its databases, trundles out a printout that wishes the subject a happy birthday, then proceeds to report on things like what happened on that day in history; who else was born in the subject's home state; what popular songs were current the year the person was born; even prices of goods, like eggs and bicycles, back then.

It will do the same for anniversaries: it prints out your names, some congratulations, and then a summary of what things were like at 5-year intervals since you were married. (Incidentally, make sure you have the proper date set in your computer; it uses the system's date in its message calculations.)

I wasn't terribly impressed with the program, but just for the heck of it I fed it Roberta's birthday and our anniversary, printed the results, and gave the printouts to her. Apparently, she rather liked them. I don't know if she'd have liked it so much if I'd paid the full \$39.95 they

want for the program, but possibly; and of course you can use it to generate birth-day cards for all your friends.

There's nothing to using Special Days; there's a manual, but I can't think why you'd want to look into it. Everything is explained on-screen, and if you do get stuck—which isn't easy—there's plenty of context-sensitive help. It's a really neat user interface.

I also have Salinon's Footprints in History. This is a more complicated program with much the same user interface. What you do is input someone's name, date of birth, and any other events (with dates) in the subject's life. The more dated events you can put in (entering school, graduations, marriage, children born, whatever), the better.

The output is a chronological table. The events come out unchanged (except that it tells you what day of the week things happened on); but they're embedded in other events. You might have: July 19, 1969, Alfred E. Neuman flunks third grade again; July 20, 1969, Neil Armstrong is the first man to walk on the moon; and stuff like that. The Alfred E. Neuman (or whomever you're making this up for) events are put in by you; the others come from the program's databases. (Most people would probably be a bit more dignified in picking events in Alfred E. Neuman's life.)

My major criticism with these programs is there's no way to add items to the program's databases. You go with what they furnish. Also, it's not clear to me what algorithm they use to select the order and importance of events: I used the "Special Day" feature of Special Days to prepare a report on July 20, 1969, and while it did tell me this was the day Neil Armstrong walked on the moon, the event it put up first was "Yoko Ono marries John Lennon."

Who knows, maybe Lennon's marriage was more important than the first trip to the moon, but you'll never convince me of that.

#### **FastTRAP**

I must have said a hundred times that I'm not fond of mice. I can never *find* the mouse, to begin with. The darned fool things are always getting buried. Once my mouse was completely buried under enough paper that the left-hand key was pressed down by the weight of the stuff on top of it. This caused weird problems when the machine was powered up and the AUTOEXEC.BAT file brought in DESQview. It took me 10 minutes to figure out what was wrong with my computer.

MICROSOFT PC Excel SPECIAL \$273

**PRODUCTS** 

Call for programs not listed

#### **TOLL-FREE ORDER LINE 1-800-421-3135**

#### NOW AVAILABLE

MICROSOFT MACH 20 ... MICROSOFT WINDOWS 386 . . . . . \$110

#### FREE SOFTWARE!

Purchase over \$100 and receive one of these disks absolutely FREE! Purchases over \$250 get two free disks, over \$400 get three, or get all four disks when your purchase is over \$500! 1) MIXED BAG. 2) PC-WRITE. 3) FONT-SET. 4) ABC-LIST.

#### SOFTWARE-

Accounting
Dac Easy Acct. 3.0 Low Price Dac Easy Light\$39 Dac Easy Payroll Low Price
Dollars & Sense         94           In House Acct.         112           Managing Your Money 4.0         117

Communication Programs
Brooklyn Bridge Universal \$75
Carbon Copy Plus108
Crosstalk XVI89
Crosstalk MK4110
Flying Dutchman
PC Anywhere III 96

Data Base Managers
Clipper \$370
Condor 3
DataPerfect Low Price
DBase III Plus
DB-XL Diamond
Fox Base Plus
Genifer
Paradox 2.0 Premium 435
PFS: Pro File
Powerbase169
Q&A 3.0
Quicksilver Diamond 329
Revelation Advanced
R Base For DOS 425
Reflex90
Relate & Report
VP Info 65

Desktop Publishing													
Pagemaker Ver. 3.0											\$	475	•
PFS: First Publisher													
Ventura Publisher .			٠	•	•			 	•	•	•	489	,

Graphics												
Boeing Graphics\$	200											
Chartmaster	199											
Design Cad 2D & 3D	148											
Diagram Master	199											
Easy Cad	109											
Generic Cad												
In-A-Vision												
Microsoft Chart 3.0	225											
Newsroom Pro												
Printshop	. 33											

	Int	e	ĭ	9	ľ	É	1	t	9	C	ı					
Ability Plus															\$	145
Enable																352
Microsoft Wo	orks	3														108
PFS 1st Cho																
<b>Smart Syste</b>																
Symphony																465
														-		

Languages
Lattice C Compiler \$220 Microsoft C Compiler Ver. 5.0 Call
Microsoft Fortran Ver. 4.1 260
Microsoft Macro Assembler Ver. 5.1 88

Languages
Microsoft Pascal\$176
Microsoft Quick Basic 4.0 59
Microsoft Quick C Call
Ryan McFarlan Fortran 390
Ryan McFarlan Cobol 612
Turbo Basic
Turbo C 1.5
Turbo Pascal
Turbo Prolog 00

Multi-User Software	
Fox Base + Microsoft Word . Word Perfect 5.0 Word Perfect Modules	. 195

Project Manager
Microsoft Project \$305
Super Project Plus 255
Timeline 3.0323
Total Havard Man. 2 355

Spreadsheet														
Lotus 1-2-3 .													\$	280
Microsoft PC	Exce	1												273
Quattro														143
Surpass														
Twin														
VP Planner P	lus .													. 88
	_													

Utilities
Core Fast Low Prices
Copy II PC
Copywrite
Cubit39
Desqview 2.01
Direct Access49
Eureka
Fastback Plus
Formtools
Mace55
Microsoft Windows 286 Ver. 2.1 59
Norton Advanced
Norton Utilities 48
PC Tools Deluxe
Prokey 4.0
Q DOŚ II49
Righwriter
Sidekick Plus
Sideways
SQZ Plus
Superkey
Lightening
XTree

Word Processing
Microsoft Word 4.0         \$185           Multimate Advantage II         285           Q and A Write         110           Webster Spellcheck         37           Word Perfect Executive         124           Word Perfect Library 2.0         65           Wordstar Pro         233           Wordstar 2000 + Personal Ed.         229

#### - HARDWARE-

Access							
Copy II PC Deluxe Bd. Curtis Ruby +						S	101
Curtis Ruby +						Ĺ	. 69
Logical Connection							429
Mach III Joystick							. 36
Masterpiece							. 85
Masterniece +							95
150 Watt Power Supply	,						. 69

Boards
AST Rampage/2Call
Rampage 286 w/512K \$299 Sixpac Plus w/64K
EVEREX 2MB Above PC/XT w/o Mem79
3MB Above AT w/o Mem 89
ORCHID Ram Quest Extra PS/2 Call
INTEL Above PC 64K
Above 286 w/512K
Ordina Tiny Tarbo

#### **COMPUTERS**

EVEDEY

EVENEX	
286, 10MHz, 0 Wait \$1149	
286, 10MHz, 1 Wait	
286, 12.5MHz, 0 Wait	
ACER	
710 w/o Monitor Call	
900 w/o Monitor Call	
SHARP	
PC 4501\$765	
PC 4521 Call	
TOSHIBA	
T1000	
T3100 Call	
T3200	
ZENITH	
Super Sport 286/20MG Call	
Super Sport 200/201/IG	
Super Sport 8088/2-Floppies Call	
Super Sport 8088/20MG Call	
NEC	
Multispeed-2 Call	
All Other NEC Products Call	
All Other NEC Products Call	

	I	4	ε	ı	ď	d	(	C	3	r	c	l	3					
Plus 20 MB																		
Plus 40 MB																. 6	559	
-										_								

Hard Drives
Seagate 20 MB w/cont Call
Seagate 30 MB w/cont Call
Seagate 40 MB AT 251-2 \$399
Seagate 80 MB AT 579
Seagate ST-125 w/cont
Seagate ST-138 w/cont 399
PriamCall

Ī

Printers
CITIZEN MSP 40 \$285 120 D 146 MSP 50 385
EPSON LQ 500. 349 LQ 850. 559 FX-850. Call
LASERS         Call           Other Lasers         Call           AST TURBO PS         Call           OKIDATA LASERLINE 6         1379           OKIDATA
OKI 320 Call OKI 321 Call OKI 390 499 OKI 391 689
STAR MICRONICS           NX 1000         180           NX 1000 Color         238

We Stock The Products That We Sell. We Are Authorized To Repair Many Major Manufacturer's Products.

Having Technical Problems? – Call Us!

Any Hardware Purchased From Us – 7 Day DOA – We Replace It – Not Repair It.

Visit Us In Phoenix! We Have A Retail Storefront To Serve You.

EGA Boards
AST VGA +\$320
All Other AST Products Call
ATI Ega Wonders 175
Genoa Super EGA Hi-Res + 186
Orchid Designer
Paradise Auto 480 179
Paradise VGA Plus
Paradise VGA Proff 399
Vega VGA

EGA Monitors						
Casper\$410						
Princeton Ultra Scan539						
Mitsubishi Diamond Scan 509						
NEC – Multisync II 609						
Zenith 14" Flat Screen 650						

Modems
AZ 2400 INT w/o Soft\$129
Everex 300/1200 w/ Soft 69
Everex 2400 EXT, Error Cor 189
Hayes 1200 EXT w/o soft 299
Hayes 1200B INT w/ Soft 289
Hayes 2400 EXT w/o Soft 435
Novation Parrot 1200 w/Soft 99
U.S. Robotics 2400 w/o Soft 335

			ı												
Genius															\$49
Logitech .															
Microsoft E	Bus	w	/F	2	ii	า	tb	r	u	s	h				. 92
Microsoft S	Seri	al													. 92
Optimouse	w/	D	rl	H	al	C	,					ĺ.			. 89
Optimouse	w/	D	P	E											185

TERMS: Shipping minimum is \$5.00. AZ orders +6.7% sales tax. Personal check/company check - allow fourteen (14) days to clear. We accept purchase orders from authorized institutions for 3.5% more than cash price. All returns are subject to our approval. There will be a 20% restock fee. Minimum phone order \$50. All prices are subject to change. Due to copyright laws we cannot take back any open software.

**TOLL-FREE ORDER LINE 1-800-421-3135** WAREHOUSE DATA PRODUCTS 2701 West Glendale Ave. • Phoenix, AZ 85051





No Charge for MasterCard or Visa

Servicing our PC buyers with low pricing and technical experience since 1979.

Phone Hours: Monday thru Friday 6:30am-9:00pm MST Saturday 9:00am-5:00pm MST

We do not guarantee compatibility



#### ATTENTION:

#### dBASE III PLUS

#### **Programmers & Developers**

Increase your dBASE III PLUS<sup>tm</sup> program speed up to 15 times!

Design and distribute compiled dBASE programs royalty-free!

Protect your vulnerable source code from inquiring minds!

Develop dBASE applications without dBASE III PLUS!

#### dBFast \$99.00

... a powerful MS-DOS compiler for the dBASE III PLUS language which explodes storage and performance restrictions imposed by other, much more expensive compilers.

#### **Lightning Compilation Speed**

Maximize programming and testing efficiency. dBFast's unique memory-resident "Engine" (only 87K) compiles typical dBASE III PLUS programs in just 3-6 seconds with no linking step required.

#### **Incredibly Fast Execution**

dBFast compiled programs run up to 15 times faster than interpreted dBASE. On independently developed test suites, dBFast has proven time & again that something indeed... outrums the fox!

#### Small, Efficient .EXE Files

With no bulky run-time library to clutter your .EXE files, dBFast compiled programs consume as little as 2K of disk space! Typical Programs take 5-30K.

#### Hassel-free Multi-User Conversion

dBFast's Autolock command enables multi-user/LAN protocols in one short line of code. Eliminates system lockups and data collision!

#### dBFast/Mac \$199.00

... a rich, interactive "Programming Environment" that allows you to combine the power and verstility of the dBASE III PLUS programming language with the intuitive human interface of Macintosh!

#### **Interactive Programming Environment**

Maximize your programming efficiency with dBFast/Mac's interactive compiler/editor. Develop, compile, debug, and run your applications - on the fly - without ever leaving this powerful programming environment.

#### **Accelerated Program Execution**

dBFast/Mac compiled programs run up to 200 times faster than interpreted dBASE. On independently-developed test suites, dBFast/Mac is up to 30% faster than FoxBASE+/Mac im!

#### Language Extensions For Mac's Friendly Interface

Easily implement the powerful Macintosh user interface adding mouse support, pull-down menus, multiple windowing, and click-on buttons to your dBASE programs.

#### dBASE III PLUS Portability

Capitalize on your prior MS-DOS development efforts by porting your existing .PRG and data files to dBFast/Mac where you may easily add the powerful Macintosh interface. Data files transfer as well, eliminating the need to rekey your data.

#### Sold By Quality Software Dealers Throughout The World

For Sales Information, Please Call (800) 356-6356

dBFast, FoxBASE+/Mac, Macintosh, and dBASE III PLUS are trademarks of dBFast, Inc., Fox Software, Apple Computers,Inc., and Ashton-Tate, respectively.

Mice are inconvenient, and often I've wished for some kind of trackball arrangement. Now I have one.

FastTRAP is a neat little trackball system with three buttons (see "Four Surrogate Mice" by Jeff Holtzman in the August BYTE). It comes with software capable of emulating any mouse you're accustomed to, and it does all that very well. MicroSpeed also encloses a little booklet illustrating 101 things you can do with your old mouse, including using the cord as a noose to hang your cat.

The FastTRAP trackball comes with a DB-25 connector. The MicroSpeed executives seemed nonplussed when I explained that most AT machines come with DB-9s on their serial ports. MicroSpeed does sell, at extra cost, a cable adapter that will let you plug FastTRAP into your AT's DB-9 port.

FastTRAP has a good hefty feel to it. The box is a bit thick for my taste. I'd have preferred it not to stand quite so high off the table, but that's certainly a matter of taste. It's not impossibly high, and indeed I can think of reasons for making it the height it is.

If you're doing CAD-type work, Fast-TRAP may be exactly what you're looking for. There are two models; one has a wheel in addition to the trackball. The wheel is used for three-dimensional data control, as in a CAD program.

For CAD and similar work, Fast-TRAP is at least as good as a mouse, and most will probably find it a lot better. Control is smooth and precise, and it's a lot easier to move the cursor across long distances. Just as a trackball is superior to a joystick for many games, it's much better than a mouse for a number of business operations.

What you can't do with a trackball is use it as an ordinary mouse. In my judgment, FastTRAP will never replace the mouse with programs like Windows or Microsoft Word, because it's almost impossible to do click-and-drag operations with a trackball system. I simply cannot hold down one of the FastTRAP buttons and simultaneously maneuver the cursor without using both hands. It isn't just me. No one else at Chaos Manor can do it, either. Human hands just aren't built that way.

It's thoroughly obvious once you think of it, but I confess this discovery surprises me, especially since I've been a strong advocate of trackballs for some time now, and I am still extremely fond of the WICO SmartCat keyboard with its integral trackball. (Alas, WICO couldn't keep the price down to anything reason-

helps save time, money, and cut frustrations. Compare, evaluate, and find products.

#### Translate for Portability, Easier Coding, Faster, Smaller Code, and No Royalties.

These are the reasons to translate from one source language to another.

Each of these products translates up to 85% - 95% of your code automatically. If you want to cut your conversion time by at least 50%

Call one of our Tech Reps for help choosing TODAY.

Order before 10/31/88 and mention "

BAS_C commercial - Basic to C	\$375	\$329	\$299	
DBX - dBASE III to C	\$550	\$529	\$449	
DBX source to libraries	\$400	\$379	\$349	
FOR_C - Fortran 77 to C	\$750	\$679	\$599	
R-DOC/X - convert WP formats	\$149	\$135	\$125	
Turbo to C-by TGL	\$595	\$549	\$499	
BYA88" for these Speci	al Pric	es		

SPECIAL

\$249

Normal

#### **386 Development Tools**

386 Assembler/Linker	PC \$ 389
386 Debug - by Phar Lap	PC \$ 129
386/DOS Extender	PC \$ 919
DESQview PS/2	PC \$ 109
F77L-EM - by Lahey	MS Call
FOXBASE + /386	PC \$ 419
High C - by MetaWare	PC Call
MS Windows/386	PC \$ 129
OS/286 & 386 by AI Architects	PC Call
Paradox 386	MS \$ 649
VM/386 multitasker - by IGC	PC \$ 229
	The second second second

#### Basic & Addons

85
139
69
139

#### C Language-Compilers

The state of the s	
AZTEC C86 - Commercial	PC \$ 499
C86 PLUS - by CI	MS \$ 359
High C Optimizing Compiler	PC Call
Instant-C/16M	PC Call
Lattice C - V3.3	MS \$ 259
Microsoft C 5.1 - with Codeview	MS \$ 299
Microsoft Quick C	MS \$ 69
NDP C-386 by MicroWay	MS \$ 529
Turbo C by Borland	PC \$ 67
Watcom C6.0	MS \$ 259
Walcom Co.u	1.10 \$ 200

#### C Language-Interpreters

and the second s		•
C-terp by Gimpel - full K & R	MS \$ 219	Э
C Trainer - by Catalytix	PC \$ 89	
Interactive C by IMPACC Associates	PC \$ 189	9
Run/C Professional	MS \$ 14	5
Run/C	MS \$ 79	9
Turbo C-terp	PC \$ 11	9

#### **CLibraries-Files**

c-tree by Faircom - no royalties r-tree - report generation dB2C Files	MS PC	\$	129 329 239 189 Call
--	----------	----	----------------------------------

#### C Libraries-General

Blackstar C Function Library	PC \$ 99
C Tools Plus - V5.0	PC \$ 99
C Utilities by Essential	PC \$ 119
Greenleaf Functions	PC \$ 129
Turbo C Tools by Blaise	PC \$ 99

#### C-Screens, Windows, Graphics

C-Worthy Interface Library	PC \$ 249
dBASE Graphics for C	PC \$ 69
ESSENTIAL GRAPHICS - fast	PC \$ 235
GraphiC - new color version	PC \$ 279
Greenleaf Data Windows - incl. source	PC \$ 229
Quick Window/C	PC \$ 75
Terminal Mapping System	PC \$ 279
TurboWINDOW/C - for Turbo C	PC \$ 75
VC Screen	PC \$ 119
View Manager by Blaise	PC \$ 199
Vitamin C - source, menus	PC \$ 159
Windows for C - fast	PC Call
Windows for Data - validation	PC Call

Note: All prices subject to change without notice. Mention this ad. Some prices are specials. Ask about COD and POs. Formats: 3" laptop now available, plus 200 others. UPS surface shipping add \$3 per normal item.

#### RECENT DISCOVERY

Compile 1-2-C - Lotus 1-2-3 to C

SYCERO db - Extensible Clipper/FoxBASE generator allows you to incorporate your code into SYCERO. Up to 30 databases, 14 indexes, 10 levels of submenus and overlaying of 26 programs. Network version available.

SYCERO db NET, \$649

#### **DataBase & File Management**

PC \$ 779
PC Call
PC \$ 595
PC \$ 169
PC \$ 499
PC \$ 719
PC \$ 549
MS \$ 449

#### **Dbase Language**

Clipper compiler		389
dBASE III Plus	PC	\$ 399
dBASE III LANPack	PC	\$ 649
DBXL Interpreter by Word Tech	PC	\$ 99
FoxBASE + V2.0	MS	\$ 259
McMax by Nantucket	MAC	\$ 235
Quicksilver Diamond	PC	\$ 369

#### **Dbase Support**

The state of the s	
dBRIEF with BRIEF	PC Call
dBC III by Lattice	MS \$ 169
Documentor - dFlow superset	MS \$ 229
Genifer by Bytel - code generator	MS \$ 249
Integrated Development Library	PC \$ 129
Networker Plus	MS \$ 229
QuickCode III Plus	MS \$ 189
R&R Report Writer	MS \$ 139
Seek-It - Query-by-example	PC \$ 79
Silver Comm Library	MS \$ 139
Tom Rettig's Library	PC \$ 79
Ul Programmer - user interfaces	PC \$ 249

#### Other Products

#### **New Greenleaf Library**

Greenleaf SuperFunctions - Over 350 new functions. Expanded memory interface. Mouse interface, interrupt processing, and numerous date and time routines.

#### THE PROGRAMMER'S SHOP

5-B Pond Park Road, Hingham, MA 02043 Mass: 800-442-8070 or 617-740-2510 8/88 Call for a catalog, literature, and solid value

800-421-8006

#### BRIEF" Users

NOW you can have fast compilation AND an integrated, productive environment.

• ver 5,000 of you were forced to make sacrifices to use BRIEF, The Programmer's Editor. Advanced compilers and new programming environments, like Turbo C and QuickBASIC, took up so much RAM that BRIEF could not fit in the same 640k.

If you wanted to retain BRIEF's uniquely powerful features1 while working with larger programs, you had to sacrifice speed and continuity. Instead of a tight Edit-Compile-Edit loop, you had to slog through an obsolete Edit-Exit-Compile-Exit-Edit loop.

#### Now you no longer have to make that sacrifice.

You can enjoy the features 1 that have made BRIEF the best-selling and the best regarded<sup>2</sup> programmer's editor without sacrificing environment integration.

> Version 2.1 of BRIEF can be swapped in and out with a single keystroke — allowing immediate compilation with even the largest compilers: Microsoft C5.0, QuickC, Turbo C, Lattice C, dBXL, FoxBASE+ v2.0, Clipper, etc.

<sup>1</sup> For example: real multi-level Undo (not simply Undelete), flexible windowing, unlimited file size, unlimited number of simultaneous files, automatic language sensitive indentation.

<sup>2</sup> For example:

"The quintessential programmer's editor." — Dr. Dobb's Journal "Right out of the box, it's a versatile, extremely powerful editor that handles most any programming task with aplomb." - Computer Language learn and use and extremely sophisticated.
Strongly recommended." — PC Magazine "Not only the best programmer's text editor I've ever seen, but it is also a tour de force in the way it was conceived and implemented."

Computerworld "So far surpasses users" expectations that it is revolutionary." —

\*\*FigraTimes Magazine "BRIEF is truly outstanding." - Microsoft Systems Journal

#### **Current BRIEF Users:**

Call Ann for details on 4 other important enhancements. Registered users of versions 2.0 or 2.01 update for only \$35.

#### Haven't tried BRIEF yet?

BRIEF retails for \$195. Call Ann today for a no-risk, 60-day trial with a full, money-back guarantee.

Call toll-free today 800-821-2492

Solution

541 Main Street, Suite 410 South Weymouth, MA 02190 617-337-6963

able and no longer makes that keyboard, which is a real pity.) Of course, the WICO trackball keyboard came out well before click-and-drag became established as a standard mouse operation: I never had to use the WICO keyboard that way, or I'd have discovered the difficulty long ago.

It should be possible to design a trackball that would allow click-and-drag, but the ball would have to sit to the side of the buttons, which would preferably be on

the side of the box enclosing the trackball; it's hard to describe what I'm talking about, but imagine a keyboard with a trackball in the upper right corner (for right-handed operations) with three buttons on the side of the keyboard where your fingers would naturally rest if your thumb were on the ball. This would be at least as easy to use as a mouse. But I don't know of anyone who makes or plans such a keyboard.

I've just discovered that if you install

FastTRAP as a two-button Microsoft Mouse, the middle button toggles drag on and off. This isn't as convenient as mouse click-and-drag, but it is possible to do it, and with time one might find that better than mouse operations. I'll try it for a month and let you know.

#### Choice Words

A long time ago, Mike Wiener of Microlytics showed me an upcoming product, which turned out to be WordFinder, a synonym program based on algorithms developed at Xerox PARC. Mike thought there was a terrific product lurking in the Xerox algorithms, and since PARC didn't seem interested in developing it, he did under a joint venture agreement.

I've used WordFinder ever since. It works fine with the word processors I like, including Q&A Write; you can even get WordFinder at a discount when you buy Q&A Write. I like WordFinder, so I've paid little attention to other thesaurus and dictionary programs, on the theory that if it ain't broke, don't fix it.

That may have been a mistake.

Proximity Technology's Choice Words, which is based on the Merriam-Webster Webster's Dictionary and Webster's Thesaurus, is at least as good as WordFinder, and in some ways it is better. Choice Words will tell you what parts of speech your word may be and offer definitions by categories. It gives tenses for irregular verbs. It offers synonyms under different connotations of the word.

Installation of Choice Words is utterly simple. Just run the Install program, which, so far as I can tell, does nothing but create a subdirectory and copy the five disks into it.

Choice Words can be run as a pop-up program from within your word processor or as a stand-alone program. By far the better way to run it is as a pop-up, since that lets you use it while editing documents. There are two ways to do this. The simplest is to go to the directory containing Choice Words and type PROX to invoke the program. Once that's done, you can go to your word processor's subdirectory and bring in your text editor. The default pop-up keys are Alt/Left Shift/T for thesaurus and /D for dictionary. You can change those keys to almost anything you like.

The other way to install the program is to put its subdirectory in your AUTO-EXEC.BAT PATH statement. Either way works fine. You can also put Choice Words into the same directory as your word processor, then bring them both up

continued

# HOW TO GIVE YOUR COMPANY A PIECE OF YOUR MIND.

Your company's most valuable resource is the knowledge and expertise of your key people. That's why you want to capture that expertise with 1st-CLASS Expert Systems so you can use it whenever and wherever needed.

■The power you need. Without the programming. 1st-CLASS<sup>®</sup> is the expert system development tool you've been waiting for. It's full-featured and flexible, yet exceptionally easy to use. Multiple knowledge representations, and interfaces to windows, graphics, and programs (including Lotus 1-2-3° and dBASE\*) make it powerful enough for technical people, yet simple enough for those with no programming or artificial intelligence experience.

■ Benefits you'll see right away. Because 1st-CLASS is so easy to use, it starts delivering benefits right away. Accurate and consistent decisions throughout your company. Reduced costs in manufacturing and support. And above all, a chance to apply the expertise of your best people to more situations than ever before.

■ Whether you're a startup or a Fortune 500, you'll quickly find 1st-CLASS a great help for your entire organization. Just as Du Pont, Travelers, Chrysler, Intel, IBM, and over 5000 others have already found out for themselves.

Priced from \$495. to \$1295. No fancy hardware required (just IBM or compatible PC). And no royalty fees or other hidden charges later on.

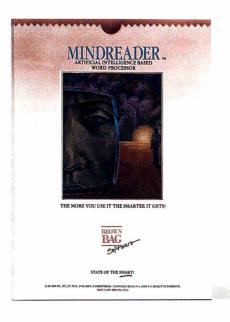
Ask for your tutorial package. It has everything you need to get moving fast, including a trial version of our newest release, 1st-CLASS FUSION.™

Why wait? Call toll-free today to order your tutorial package: 1-800-872-8812.

Expert Systems, Inc.

286 Boston Post Road Wayland, MA 01778 (617-358-7722 in MA). For the IBM®PC. For the DEC VAX®(with added hardware). Priced from \$495 to \$1295. Tutorial package only \$20.

## SUGGESTION BOX.



"MindReader's artificial intelligence approach to word processing is a technological breakthrough!"

-PC Magazine

#### MindReader.™ It's right for you because it writes for you.

MindReader, a new generation of software, is the first giant step toward the word processor of the future. The more you use it, the smarter it gets.

Its patented Artificial Intelligence Engine picks up your writing pat-terns. Then, as if it's "reading your mind," it anticipates what you're going to write next; suggesting words, phrases, paragraphs and even signature blocks in a "suggestion" window.
Simply select the appropriate

suggestion with the press of a single key. Or continue typing.



#### "Hunt & peck" at a blistering speed!

MindReader is not just a simple editing tool. It's positively POW-erful! Here are just a few of its highly acclaimed features:

- Full-feature Word Processor
- Mail Merge

- Glossary for 260 of your "boilerplate" sentences/paragraphs.
- In-text mathematics with decimal tabs
- Text encryption/ ■ Name & address book decryption
  ■ On-screen drawing mode ■ Plus FREE toll-free
  - telephone support for ■ And MORE!

#### MindReader saves time and reduces errors!

With just a simple touch of a key, it can turn an earnest nonprofessional into an Ernest Hemingway.



Or turn an ant into antidisestablishmentarianism. It's absolutely revolutionary!

In fact (if you like FACTS), after a few sessions with MindReader, your keystrokes will be reduced by as much as 80 to 90%.

No wonder PC Magazine awarded MindReader with their coveted "Editor's Choice."

#### A little skeptical?

Get a copy of MindReader to try for 30 days. (And while you're at it, pass copies around to your friends and associates for their evaluation.) If not totally sold on us, don't pay us a cent.

No risk. No hassles. No fooling.

(This free 30 day evaluation period is available on all Brown Bag Software.)

Quantity discount and site licenses available. To order call

800 523-0764 In California, call (408) 559-4545. Or send your check for

**\*89.95** (750 shipping & handling CA residents add sales tax) Brown Bag Software® File #41719, Box 60000 San Francisco, CA 94160-1719 🐷 🕽



#### State-Of-The-Smart.™

Offices in London 01 831 1106— Köln 0221 7710923—Copenhagen 01 933837— Amsterdam 020 233408—Zürich 01 2146224

© Copyright 1988 Brown Bag Software, Campbell CA 95008

\*Our Shareware versions are older versions of our product, but are full-featured & fully-functional and yours to try for a FREE 30 day evaluation period.

with a batch file. The important thing is that all the methods work, and I had no trouble doing them. Like WordFinder, it works well with DESOview.

Choice Words works with a variety of word processors, including difficult ones like Q&A (and Q&A Write) and Microsoft Word. It's very fast, at least on my big Cheetah 386, and comparable in speed to WordFinder on all the machines we tried it on.

I find I'm not a big user of thesaurus programs. I practically never use one when I'm actually writing. On the other hand, I always load one into the system when I bring up a text editor, and when I'm doing a final edit on text, I do call up the thesaurus sometimes. If I didn't have one, I'd buy one; but then, my business is words. I don't have to use a tool very often to justify having it.

As to which one I'd buy, WordFinder or Choice Words, I confess I don't know. They're both very good. Choice Words gives you more information, but a consequence of that is it takes you a bit longer to use it. WordFinder is fast and nearly invisible until you want it, and it may give you all the information you need.

Unlike WordFinder, Choice Words includes a very good dictionary program; if you have any need for an on-line dictionary (as opposed to a thesaurus), I haven't seen anything nearly as good.

If you do much writing, you'll probably want one of these programs. Choice Words is a good deal more than good enough. It's at least equal to the best.

#### Sprint

Philippe Kahn has been telling me about Sprint, Borland's new text editor, for over a year. Every few months, he'd offer me a copy; then, just before I got it, there'd be some new improvement they wanted to perfect. After a year of this, I finally got the program from Philippe himself when I visited him in Scotts Valley. We used LapLink to squirt it over from Philippe's Compaq portable to my Zenith Z-183.

That may not be the best way to get the program. I've found that demonstrations by an enthusiast tend to skip over difficulties that inevitably surface later. That was surely the case this time.

I don't have time to go through all the steps that lead me to this conclusion. Let me just state it: Sprint is a contender for the best word processor on the market today. It's fast and extremely powerful. It is almost completely customizable. It works with PostScript and all the other advanced stuff that's coming. It supports darned near every printer known to man and is able to make use of many of the fanciest features, including proportional spacing, automatic kerning, and the lot. It does indexing, and it sort of does outlining, although I would be surprised if a creative writer actually uses the severely limited outline processor in the current version. Sprint will make tables of contents and figures. It will work with short or long documents.

Sprint has a "swap file" system that automatically and unobtrusively saves your work every 30 seconds or so, so that even with a power failure you won't have lost much. I noticed that Philippe routinely shuts down his portable simply by turning it off: no saving his work, no exiting from Sprint. Just pull the plug in full confidence that everything will be there next time you power up. I'm writing this on one of the hottest days in the history of Los Angeles, with power fail-

# treedom of Press



Over the last few years, Adobe Systems has brought forth some very revolutionary ideas.

Such as the Adobe PostScript® page description language. Adobe® Type Library. Adobe Illustrator 88. The Display PostScript™

Software that gives you the freedom to create professional-quality reports, newsletters, business graphics and more. Using virtually any kind of computer. IBM® PC. Macintosh® Mini or mainframe.

That's why choosing printers with Post-Script software is your declaration of vendor independence. It's the only standard adopted by virtually every major company in the computer industry.

So any computers you have will work with any printers you buy equipped with Post-Script software.

And that means even more choices when it's time to print. You can use laser and color printers. At a variety of resolutions. Or even professional typesetters.

The Adobe Type Library also gives you

Adobe, Adobe Illustrator and PostScript are registered trademarks and the Adobe logo, Adobe Illustrator 88, Display PostScript and the PostScript logo are trademarks of Adobe Systems Incorporated. IBM is the registered trademark of International Business Machines

ures everywhere, so I appreciate a feature like that.

Having given my conclusion, let me add some qualifications. Sprint is not a text editor for everyone. Some users will love it. A good many others will really hate it. To explain why, I'll have to give some background.

Sprint was originally based on EMACS, one of the world's first fullpage text editors. EMACS was written in TECO for big multiuser minicomputers (PDP-10 and PDP-11) at MIT by Richard M. Stallman, generally known as RMS. Stallman, who is famous for his view that software ought to be free, gave EMACS away. If he hadn't, he'd be a rich man. In its day, EMACS was the best programming editor in the world.

EMACS was then modified for microcomputers by an outfit called Mark of the Unicorn, and it appeared as a CP/M commercial product called The Final Word. Later, they put out a PCompatible version. Sprint is two generations later than that.

EMACS was a programmer's editor. It was adequate for writing text-indeed, it was a lot better for that than anything else available at the time-but it wasn't designed by a professional writer. Some additional features were suggested by writers, including me, but RMS is the archetypal hacker, and he included in EMACS everything he could think of. He then added a programming language that would let you do all the things he hadn't thought of.

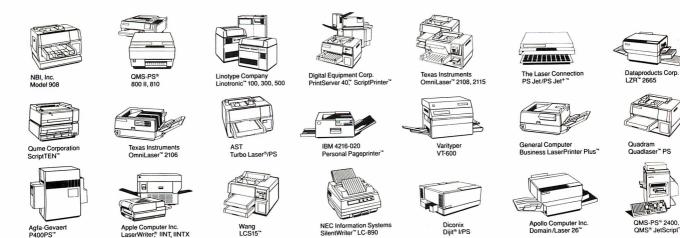
The result was a hacker's dream—and very nearly a user's nightmare. Every key did something; EMACS was the original source for the joke about programs with Control-Alt-meta-cokebottle commands. The EMACS philosophy was that you could do anything you wanted if you would take the trouble to learn how. Surely you should do some of the work?

I was invited to learn EMACS in the 1970s when I had an ARPANET account at MIT. There was a TeachEmacs program running on the MIT computer, and that plus determination got me familiar enough with the program that I could use it. I even wrote an early BYTE column on-line using EMACS, and for a while there was a notion that Marvin Minsky and I would write a book together, with EMACS as the editor of choice.

The Minsky project died because we both had heavy schedules, and, besides, you can't really do a major project at 300 bits per second. Then I lost my AR-PANET account. After that, I had no reason or opportunity to use EMACS until Mark of the Unicorn brought out their CP/M version, and they didn't send me a copy of that for a year or so.

By then, my mad friend MacLean and I had induced Tony Pietsch to customize his WRITE program to our specs. That was good enough that I wasn't much tempted to try anything else as long as I was using CP/M. When I changed from CP/M to PCompatibles, I didn't have MINCE (MINCE is not a complete EMACS), or The Final Word, or whatever EMACS had evolved into by then. Consequently, I haven't really used EMACS for 10 years. Then I got Sprint.

A lot of the rough edges have been knocked off, but Sprint has kept a great deal of the flavor of EMACS. In particular, it retains much of EMACS's flexibility. You don't reprogram Sprint in the same way that you would have programmed EMACS; indeed, Sprint is



choices—literally hundreds of typefaces that let you communicate any idea more effectively.

Adobe Illustrator 88 software gives you freedom, too.

It lets you easily create anything from simple line drawings to complex masterpieces. Even if you can't draw a straight line.

And our new Display PostScript software

is a powerful system that brings the power of Adobe's PostScript software to any PC or workstation display.

So before you invest in any laser printer, make sure it's equipped with PostScript software from Adobe.

For more information, call 800-29-ADOBE.

Because Adobe's PostScript software is your only guarantee of true freedom of expression.



Look for this symbol on computers, printers and other products that support PostScript software from Adobe Systems. It's your guarantee of quality and connectivity.

Macintosh is the registered trademark of Apple Computers, Inc. ©1988 Adobe Systems incorporated. All rights reserved. This ad was produced using the Adobe Type Library and PostScript printers and typesetters. The illustrations were created with Adobe Illustrator® software

more awkward in that respect. There's no miniwindow in which you can run miniprograms.

On the other hand, you can build really elaborate macros, either by putting them together yourself or by putting Sprint in learning mode and simply doing what you want it to learn. There are features it doesn't have that I've got in O&A Write (just because O&A Write is easy to use doesn't mean it isn't sophisticated and powerful), but that's quibbling; the bottom line is that Sprint has the most elaborate and powerful macro reprogramming capability of any editor on the market.

Sprint's concession to new users is an elaborate menu system, in which each menu item lets you call a submenu. It's all reminiscent of Wirth's Lilith operating system. There's a fast way to bypass the menus once you're familiar with Sprint. Until then, you can cascade through the menus until you find (sometimes with some difficulty) what you want Sprint to do, and then have it execute the command from within the menu

The menus include a truly amazing selection of predefined macros and pragmas (sort of a programming primitive command). There's a DeleteToLineEnd pragma, as well as DeleteLine. Either one can be assigned to any Alt or Control keystroke you like. There's also exist [filename], which returns TRUE if the program can find a disk file called filename. There's mark, which will put a mark in your file. There's SetLeft-Indent, and DeleteRegion, and flags, and I'm sure you get the idea. There are literally dozens of such pragmas, and in case you can't do what you want with one, you can probably build a macro out of several to do the job.

In addition to all that, Sprint comes with a series of preprogrammed setups that allow it to emulate the command interface of a dozen other popular text editors. Note the emphasis on command; Sprint does not, contrary to what you may infer from Borland's advertising, emulate the screen and reporting interface of any other word processor. Sprint looks like Sprint no matter what it's emulating.

Of course, you can do a lot with Sprint's screens, too. Colors are adjustable. So are on-screen margins. Also. you're not stuck with what you see on the screen: Sprint, like Electric Pencil, WordStar, and WRITE, lets you embed print formatting commands into the text, so that what you see isn't necessarily what you get. For some people, that's a

feature. Others, however, will consider it a bug.

Sprint's use of embedded formatting commands means that Sprint files are clean, plain ASCII with some control characters. That makes it easy for popular writer-assistant programs, such as Grammatik III and Readability, to access and alter Sprint files. One of my main difficulties with O&A Writewhich is what I'm still using-is that it

the rough edges have been knocked off, but Sprint has kept a great deal of the flavor of EMACS, an early fullpage text editor.

stores a status word for every line. This gives Q&A Write great power but makes it impossible to use any kind of external program that changes line lengths. Microsoft Word has much the same difficulty. Sprint doesn't.

The good news, in other words, is that Sprint really has retained the old EMACS flexibility. You can use it to design your own basic interface, then begin to add macros until you've got something that's extremely powerful and uniquely yours, adapted to the kind of work you do. After a while you'll have written your own text editor, one that caters to your every whim and idiosyncrasy.

The bad news is that Sprint isn't really very nice until you've done the customization. Indeed, when you first set the program up, it can drive you half out of your mind. No matter what emulation interface you adopt, Sprint isn't going to work the way you expect it to-not until you get used to it. Vanilla Sprint is pretty god-awful, especially if you're asking it to emulate something else you're accustomed to, because while Sprint in emulation mode may-more or less-do what you expect it to when you give it a command, it sure won't *look* like what you're accustomed to seeing while it does it.

Of course, this all reminds me of Xy-Write, which is also easily customized and isn't very useful until you've done that. XyWrite has been around long enough that there are precustomized specialized versions, such as Nota Bene, adapted for particular purposes. Sprint is still new, but I predict it won't take long before third parties will sell you Sprint customization packages.

More important, though, is Borland's upgrade policy. If you buy a copy of Sprint now, you can have confidence that Borland will pay attention to user and reviewer complaints and suggestions, bring upgrades out in a timely manner, and not charge you a fortune for the upgrades when they're released. I've made several suggestions that Philippe Kahn has his people working on, and I'm quite sure I'm not the only critic he pays attention to. As an example, Sprint doesn't yet import and export Atex files, but Borland is working on it.

Sprint makes it pretty easy to change over from your old word processor, in that it will import and export files to and from DisplayWrite, Microsoft Word, MultiMate, MultiMate Advantage, Wang IWP, WordPerfect 4.2, WordStar, and WordStar 2000—and, of course, ASCII. The conversions are quick and painless. Even if you hate Sprint, it may be worth buying for this feature. I have seen conversion programs no better than this sell for more than Sprint does. Of course, it does not convert Q&A Write files, which is one reason I'm not using Sprint to write this column. Maybe a later version

My conclusion on Sprint is that if you're a professional writer concerned with your tools, Sprint is more than worth looking into.

If you write a lot and aren't happy with your current text editor, consider Sprint.

If you're just getting started using a computer for writing, don't start with Sprint unless you're prepared to put some time into it. Sprint was written for sophisticated users who are prepared to put some effort into learning it and customizing it. I don't mean that beginners can't use it; but they're likely to be frustrated for a while. Sprint isn't as easy to use as Q&A Write, for example.

If you're responsible for setting up and customizing text editors for a whole bunch of workstations, Sprint is worth looking into. Assuming you know what you're doing, you can customize it for your establishment. Also, suppose you have engineers or analysts who prefer to use their own editor but you want to integrate their work. Sprint can read in all their files, merge them, and write out

# Periscope's New Version 4

Model I Board

memory board keeps all debugging nformation out of the lower 640K. Can be used in

PCs, ATs, and 386s with both EGA/VGA and EMS boards

installed. The Periscope break-out switch enables you to recover from a hung system. Included with Models I, II, and III.

**Gives you all the right stuff for debugging! No matter which model you pick, you have the same powerful software to help you track down hard-to-find bugs fast.** 

Periscope's hardware adds the power to solve the really tough debugging problems.

The break-out switch lets you break into the system any time. You can track down a bug instantly, or just check what's going on, without having to reboot or power down and back up. That's really useful when your system hangs! The switch is included with Periscope I, Periscope II, and Periscope III.

Periscope I has a NEW board

with 512K of write-protected RAM, user-expandable to 1MB, for the Periscope software, symbol tables, and all related debugging information. Normal DOS memory (the lower 640K) is thus totally freed up for your application, and Periscope is protected from being overwritten by a run-away program. The new board's footprint is only 32K, so you can use it in PC, AT, and 386 systems with EGA/VGA and EMS boards installed (not possible with the previous 56K board). It can also be used with Periscope III to provide additional write-protected memory.

Periscope III has a board with 64K of write-protected RAM to store the Periscope software and as much additional information as will fit. AND...

The Periscope III board adds another powerful dimension to your debugging. Its hardware breakpoints and real-time trace buffer let you track down bugs that a software-oriented debugger would take too long to find, or can't find at all!

The Periscope III hardware-breakpoint board captures information in real-time, so you'll find bugs that can't be found with a software-based debugger.

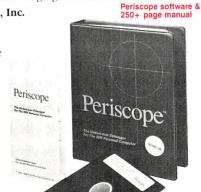
#### Periscope's software is solid, comprehensive, and flexible.

It helps you debug just about any kind of program you can write...thoroughly and efficiently.

Periscope's the answer for debugging device-drivers, memory-resident, non-DOS, and interrupt-driven programs. Periscope works with any language, and provides source and/or symbol support for programs written in high-level languages and assembler.

David Nanian, President of Underware, Inc. (of BRIEF fame) says this about the new Periscope Version 4:

"Periscope has always been an unbelievable assembler-level debugger. Version 4 has turned it into a terrific source-level debugger as well. Aside from major enhancements like the source-level improvements, all the little changes make a really big difference, too. For instance, symbol lookups and disassemblies are noticeably faster, and highlighting the registers that have changed really makes life easier. Once again, Periscope has raised the industry standard for debuggers!"



#### What's New in Periscope Version 4:

- View local symbols from Microsoft C (Version 5)
- Debug Microsoft windows applications
- Set breakpoints in PLINK overlays
- · Improved source-level support
- · Monitor variables in a Watch window
- 80386 debug register support
- Debug using a dumb terminal
- PS/2 watchdog timer support
- Use mixed-case symbols
- · Set breakpoints on values of Flags
- · Much more!
- Periscope I includes a NEW full-length board with 512K of write-protected RAM; (user-expandable to 1MB); break-out switch; software and manual for \$695.
- **Periscope II** includes break-out switch; software and manual for \$175.
- Periscope II-X includes software and manual (no hardware) for \$145.
- Periscope III includes a full-length board with 64K of write-protected RAM, hardware breakpoints and real-time trace buffer; break-out switch; software and manual. Periscope III for machines running up to 10 MHz with one wait-state is \$1395.

Due to the volatility of RAM costs, prices on board models are subject to change without notice.

**REQUIREMENTS:** IBM PC, XT, AT, PS/2, 80386 or close compatible (Periscope III requires hardware as well as software compatibility, thus will not work on PS/2 or 80386 systems); DOS 2.0 or later; 64K available memory (128K at installation time); one disk drive; an 80-column monitor.

Call us with your questions. We'll be happy to send you free information or help you decide on the model that best fits your needs.

Order Your Periscope, Toll-Free, Today! 800-722-7006

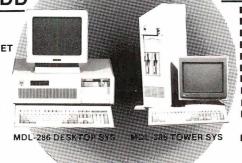
MAJOR CREDIT CARDS ACCEPTED



## BEST BUY IN THE MARKET!

## 80286 EGA SYS w/

- 80286-10 (10/6 MHz) 640K RAM
- 1.2MB FDD 200W POWER SUPPLY
- 101 KEYBOARD 808287 MATH SOCKET
- W.D. CONTROLLER (2 HDD, 2 FDD)
- TURBO-SPEED BUTTON W/LED INDICATOR
- **KEYBOARD LOCK & RESET BUTTON**
- PHOENIX BIOS 20 MB HDD (ST-225)
- SERIAL, PARALLEL, GAME PORT
- EGA G CARD (AUTO S/W)
- **EGA MONITOR (640 x 350)**
- COMPUTER CABINET DIMENSIONS 21"L x 16.5"W x 6"H



TURBO-XT MONO SYS W/20MB HDD

- 8088-2 8 MHz TURBO CPU
- 640K RAM 1-360K FLOPPY DISK DRIVE
- 1-20 MB HARD DISK W/CONTROLLER
- CLOCK CALENDAR W/BATTERY BACKUP ■ SERIAL,PARALLEL,GAME PORT
- MONO GRAPHIC CARD
- 12" TTL AMBER MONITOR
- FRONT RESET & TURBO SWITCH
- POWER & TURBO LED INDICATOR
- 101 FULL FUNCTION ENHANCED KEYBOARD
- **150W POWER SUPPLY**





OPTION: ■ 12MHZ 0 WAIT STATE
OPTION: ■ NEW COMPACT SIZE CABINET
(DIMENSION - 14.5"W x 16"L x 7"H)

80386 COMPUTER SYSTEM W/40MB HDD

- 32 bit 80386-16 MHz CPU 40 MB HARD DISK (ST-251 40ms)
- 1 MEG RAM (80ns) 1.2 MB FLOPPY DISK DRIVE
- 200W POWER W/DESKTOP CASE
- SERIAL, PARALLEL, GAME PORT 🔳 101 ENHANCED KEYBOARD
- MONO GRAPHIC CARD 14" TTL AMBER MONITOR





Circle 248 on Reader Service Card

HEAD OFFICE 12603 S. CRENSHAW BLVD HAWTHORNE CA 90250 M:F 8 30:5 30 (213) 644-1140 ORANGE CO STORE 108 W KATELLA AVE M:F 10:6

ORANGE CO STORE
108 W KATELLA AVE M-F 10-6
ORANGE CA 92667 SAT 10-5
- (714) 538-0929

1 YEAR WARRANTY PARTS & LABOR ALL ITEM

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CALL FOR OTHER CONFIGURATIONS!

8-00 DAY MONEY BACK GURBATILI!

TOUR COMPLETE SAISFACTION IS DURITOP PRIORITY ARY SUNTRONIC SYSTEM MAY BE
RETURNED WITHIN AUDAN'S FROM THE DATE OF SHIPMINET THE RETURN DESS SHIPPING CHARGE

\* ITEMS RETURNED MUST BE AS-NEW WITHOUT MODIFICATION OR DAMAGE ALL MANUALS AND PACKAGING MUST BE INCLUDED RETURN SHIPPING MUST BE PREPAID AND INSUREI BEARING A RMA (RETURN MATERIAL AUTHORIZATION, ON THE SHIPPING LABEL

#### CHAOS MANOR

files in an alternate file format.

If you're a programmer, Sprint is very much worth looking into. After all, it was designed by the hacker's hacker. At the moment, Sprint doesn't really "understand" very many computer languages; but the macro capability is powerful enough that it won't be long before people teach it to, say, look for unbalanced parentheses in BASIC, unclosed parentheticals in Lisp, improperly structured procedures in Pascal, and that sort of thing. I know Sprint can do this, because there have been language-specific configurations of EMACS for at least 10 years.

If you write a lot, you're happy with what you have, you don't want to customize, and you'll be blasted before you'll spend the time to learn how to set up and use yet another word processor, ignore Sprint.

If you're furiously busy (as I am), pretty well satisfied with your current text editor (as I am), but wish you could teach it to do other tricks (as I do), then it's worth getting Sprint to play with and begin the—sometimes painful—process of customization (as I am doing).

Borland's new word processor is recommended, with qualifications.

#### Lascaux:

#### "The Intelligent Calculator"

I get about a hundred programs a week. I can't possibly look at them all, but since I do try to balance this column, I periodically sift through piles. What I'm looking for is something new and different, and preferably published by someone you never heard of. After all, that's the way I discovered Turbo Pascal. Alas, I'm much more likely to discover Lascaux than another Turbo Pascal.

I don't think Lascaux is a potential Turbo Pascal, but it is more interesting than much of the garbage I get. It's a scientific calculator program; what makes it more than Yet-Another-Program is its handling of units (e.g., feet/meters and kilograms/pounds). According to the thin but readable instructions, you can teach Lascaux almost any units you like, after which it will convert as required when it calculates. Since it also does logs, trig, and fractional exponents, this looked like something pretty useful. I don't do as many orbital calculations as I

used to, but I do try to keep my hand in.

Back in my aerospace days, we once converted the cruising speed of the TFX fighter (which became the FB-111) into furlongs per fortnight. I thought it might be fun to do that again, and Lascaux looked to be the tool to do it with.

Well, it will do it, but it's more work than I thought it would be. First, you have to install Lascaux. This isn't a matter of copying some files. The silly programmer has made it much more complicated than that. You tell the Install program on the distribution disk what options you want, and it generates a working version of Lascaux for you. The options are with and without math chip, and memory-resident or stand-alone. Why they don't include all four and let you manage by selective copying and renaming files I don't know.

Once you've got this thing installed, you may be tempted to copy the Tutorial program into the same directory as you've put the main program. Do not do this. The Tutorial disk contains files that have the same names as Lascaux regular files, but which are brain-damaged. The

# S P E C I A L E D I T I O N

He visits SYSTEMS 89. This is where decisions are made. He gathers information on the range of products available and makes new business contacts. As highly qualified expert, he is his company's head buyer and decision-maker. He is aware of his responsibility and looks for solutions by talking with suppliers. He is responsible for important investments and concludes contracts for his company. He has both feet on the ground. His word goes—for orders, prices and deadlines.

SYSTEMS represents the state of the art in computers and communications. The 11th international trade fair and congress will be held in Munich in 1989. SYSTEMS is an absolute must for the entire DP industry. Highly qualified experts and decision-makers, distributors, buyers and OEMs from all over the world gather information at SYSTEMS on modern communications technology and applications. Make contacts that are worthwhile! In 1987 alone, there were 146,000 visitors to the trade fair. SYSTEMS 89 offers the right setting for optimum product presentation and for profitable talks between users and suppliers. If you need further information, simply ring: Munich, Phone (89) 51 07-0, Italy, Phone 0376-969235/6, France, Phone (1) 45 75 62 56, Great Britain, Phone 01-948 5166/940 4625, USA, Phone (201) 652-7070, Japan, Phone (03) 593-1641 (Tokyo), (06) 447-0021 (Osaka).

> SWHIS/S SWHIS/S

Computers and Communications 11th International Trade Fair and International Congress Munich, 16—20 October 1989



MESSE MÜNCHEN INTERNATIONAL

unit tables are all scrambled up. After you run the Tutorial program (and you had better run it, because Lascaux's user interface is quite hostile and rude into the bargain) and then try to run the program itself, it won't know what you're doing, and if you try to examine the units it thinks it understands, you'll see only garbage. The only remedy is to go back and run Install again.

After that, you've got to do some definitions. Lascaux understands what a "sec" is, but if you want something per second, you'll have to tell it that 1 second is one sec. It knows "ft" but not "foot." There are other bothersome omissions.

If you're trying to define complex units, you can really go nuts. Although Lascaux has some units that have spaces in them—Light Year is an example—if you want to define something as, say, furlongs/fortnight, you *must not* type in the "/"; instead, you just put in a space and hope that the program infers what you want.

Once you get past the badly designed user interface, Lascaux actually works pretty well. It's fast. There are built-in units and constants. Oddly enough, how-

ever, "Speed of Light" is a constant (in meters/second—or as Lascaux would have it, meters sec), not a unit. You can't define the unit "c" as Speed of Light because "C" is defined as a coulomb, and apparently the program isn't case-sensitive unless it wants to be. I see I'm complaining again.

There is a rather badly documented "rename" feature; judicious use of that will solve a fair number of this program's problems. Indeed, the program itself is better than my impressions of it, which proves that if you're going to market programs, you probably ought to put a good bit more time into editing the program documents and smoothing the user interface than most programmers do.

I do find Lascaux useful; perhaps I ought to revive my old classification of "infuriatingly excellent."

Incidentally, the speed of light is 1,802,617,752,326.41 furlongs/fortnight.

#### MacMadness

We had a party here last night, and my son Alex's friend Clydene Nee brought up some University of California at San Diego public domain programs for my Mac II. (Available on most Mac bulletin boards, or bug Alex to get them onto BIX.) Now when I turn on the machine, I get ruffles of drums, the Twentieth Century Fox fanfare, and barking dogs. It's great sound, amazingly good quality for such a little speaker; indeed, it's good enough that I'm going to treat my Mac II to a real speaker and sound system. There are other fun programs, too.

One of the guests at the party was Kelly Freas, probably the best-known illustrator in the science fiction world. I'm rather proud of the book covers he's done for me. Kelly and his new bride Laura (she's at our local good music station, and on the air right now) were wondering what they should get for a computer, given that they'll need it to run his business. I thought about that all night.

I'm recommending a Mac II. For artistic work, Kelly would probably be better off with an Amiga; but I can't recommend that machine to him for his business. It's not that the Amiga can't do the job, it's just that neither Kelly nor Laura have much experience with small computers, and I'm afraid the Amiga isn't reliable enough unless you know a lot about the machine. The Mac II is just more stable.

I could have recommended a good 80386 PCompatible like the Zenith, especially now that SoftView has put out MacInTax in a PCompatible (Windows) version; but that's a stick shift machine. Mostly though, I think Kelly will just plain have more fun with a Mac.

I did notice that at my party people stood in line to play with the Amiga.

#### Winding Down

I'm out of space and there's still tons of new stuff. I have a new Vega VGA board from Video Seven that's said to support Windows/386 at blazing speeds; I can't wait to try it. There's Shoebox, a program that's supposed to help you manage small businesses (the kind that stuff receipts and notes into shoe boxes) and is spoken highly of by people I respect. There's a whole raft of scientific and engineering programs from MacNeal-Schwendler. They do practical problems like heat transfer, flight dynamics, and civil engineering, and a number of professionals swear by them.

I've got new facsimile and CD-ROM equipment for my Mac II.

The book of the month is by Robert Forward and Joel Davis, *Mirror Matter* from Wiley. Bob Forward is senior fellow emeritus at Hughes Research Lab-

continued





For IBM® PC's, XT's, AT's and other DOS machines. Needs only 1 disk drive and 128K memory. This is the one you've heard so much about - with fast compile times, small object code modules, not copy protected, no royalties, and clear error messages. Version 5.0 is based upon ANSI-74 standards with new dynamite features including:

Nested IF's and nested conditions.

 Indexed files (ISAM) with up to 24 keys (includes START verb). This advanced feature requires the software package Btrieve® which is optionally available.

• ACCEPT (line, column) numerics with decimal point alignment, numeric checking, AUTO-SKIP, SECURITY, LENGTH-CHECK, EMPTY-CHECK, ATTRIBUTE (color), FROM ESCAPE KEY, DAY, DATE, TIME, DAY-OF-WEEK.

• Fast memory mapped DISPLAY's (line, column) ERASE, BEEP, ATTRIBUTE (color). Can display entire screen with one DISPLAY statement.

Windowing, pop-ups, color and overlays. This advanced feature requires the software package Saywhat?!™ which is optionally available.

 An easy to use, COBOL source code EDITOR with auto line numbering, A-margin, B-margin tabing with full screen cursor control.

Also available: Utah **SuperSort**®, a fast sort program callable from Utah COBOL; Utah **FORTRAN**; Utah **BASIC**; Utah **PASCAL**; Utah **PILOT**. Used by 50,000 professionals, students and teachers in 40 countries. 30-day money back guarantee. Discover the ease and simplicity of COBOL, today!

Phone order rushed by UPS 2nd Day Air: (702) 827-3030





Ellis Computing, Inc. 5655 Riggins Court, Suite 10 Reno, Nevada 89502

IBM is a registered trademark of International Business Machines, Inc. Btrieve is a registered trademark of Novell, Inc. Saywhat?! is a trademark of The Research Group. SuperSort is a registered trademark of Micropro International Corporation. Utah COBOL is a trademark of Ellis Computing, Inc. © 1987 Ellis Computing, Inc.

#### Great Selection + Superior Service 5 + Competitive Prices = Top Value

We have the technical expertise to fulfill your specialized needs in software development, circuit design, data analysis, CAD and much more. Call today!

ASSEMBLERS

- No one offers you more variety.
- 30-day Money-Back Guarantee
- Latest versions

MS COBOL, Microsoft... Realia COBOL... RM/COBOL-85, Austec. SCREENIO, Norcom....

COBOL

PASCAL

• Over 500 name-brand products in stock, if you don't see it - call!

#### High C, Metaware..... NDP FORTRAN, Microway PharLap 386(ASM/LINK...

386 SOFTWARE DESQuiew, Quarterdeck
Microport — Sys. V/386 Comp.
MS Windows/386, Microsoft
PC MOS/386, Software Link.
VM/386, ESOFTWARE LINK.
VM/386, SOFTWARE LINK.
SYS V 386 (complete) 5 11 76 13 CAL 18 127

EMACS, Unipress
Epsilon, Lugaru.
KEDIT, Mansfield
MULT-EDIT, American Cybernetics
Norton Editor
PC/EDT +, Boston Business Computing
PI Editor, Iliad Group
SPF/PC, Command Technology
VEDIT PLUS, CompuView

DEBUGGERS

w/Source..... Pfix86plus, Phoenix... EDITORS

FILE MANAGERS

BRIEF, Solution Systems.... w/dBRIEF. EDIX, Emerging Technology... EMACS, Unipress.

590L29	Essential Graphics Graphic, Software Endeavors GSS Graphics Dev. Toolkit HALO '88, Media Cybernetics HOOPS, Ithaca Software MetaWINDOW, Metagraphics MetaWINDOW PLUS Turbo WINDOW/C Turbo WIALO, Media Cybernetics	32 40 25 55 16 28 8
	OBJECT-ORIENTED LANGUAGES	8

SOF MARKETON

# ACTOR, Whitewater Group... ADVANTAGE C++, Lifeboat PforCe++, Phoenix. Smalltalk/V, Digitalk... Smalltalk/V286...

	OPERATING SYSTEMS	300
l	Microport DOS Merge \$ Microport Sys V/AT \$ SCO XENIX System V Wendin-DOS 2.15	549 979 109
	Other Microport, SCO, Wendin Products	CALL

SCREENS/WINDOWS	
C Scape, Dakland Group. \$ Greenleaf Data Windows MS Windows, Microsoft. MS Windows Develop. Kit, Microsoft. PANEL Plus, Lifeboat PANEL /GC or /TC Vitamin C, Creative Programming. Windows for Data, Vermont Creative. ScreenStar w/Source, Essential. SoftCode, Software Bottling Co. Turbo POWER SCREEN	282 219 319 395 149 119 101

OTHER PRODUCTS	
Advanced Norton Utilities	\$ 99
Dan Bricklin's Demo Program II MKS Toolkit	179
MS OS/2 Programmer's Toolkit	239
PC lint, Gimpel	10
Plink86Plus, Phoenix	279 359
Polytron PVCS CORPORATE Pre-C, Phoenix	
SEIDL Version Manager	269
Source Print, Aldebaran Labs	-87

#### Software Development Tools

Microsoft Macro Assembler OPTASM, SLR Systems Visible Computers80286	99 109 90
BASIC	
Flash-up, Software Bottling Co. MS Basic Comp. 6.0 MS QuickBASIC. QuickPak, Crescent Software T BASIC, TransEra Corp. Turbo Basic, Borland. Turbo Basic, Toolboxes, Borland	\$ 80 199 69 60 453 69
C	
C-terp, Gimpel 9	6 232

ADVANTAGE Disassembler, Lifeboat ....\$ 279

Lattice C. W/Source. Microsoft C. QuickC, Microsoft Turbo C, Borland	285 495 295 65
CLIBRARIES	
C TOOLS PLUS 5.0, Blaise	101 125 125 165 155 175 215 215

CIRCUIT DESIGN/SCHEMATIC CAPTURE 

	MS Pascal, Microsoft\$ Turbo Pascal, Borland Professional Pascal, Metaware	199 69 549
	PASCAL LIBRARIES (TUREO) Turbo Pascal Dev. Lib., Borland. \$ Metrabyte D&A TOOLS, Quinn-Curtis. Turbo Pascal S & E Tools, Quinn-Curtis. Turbo HALO, Media Cybernetics Turbo HAGIC, Sophisicated Software. Turbo MSGIC, Sophisicated Software Turbo ASYNCH PLUS, Blaise. Turbo Power Tools Plus, Blaise.	289 90 69 80 179 101
1	MODULA-2 LOGITECH Modula-2 Compiler Kit. Development System Toolkit. StonyBrook Modula-2.	\$ 81 199 141 179
	386 DEVELOPMENT TOOLS 386-Max, Qualitas ADVANTAGE 386 C, Lifeboat	\$ 66 839 459

Power Tools Plus, Blaise	Btrieve, Novell\$
ULA-2	Report Option Btrieve/N, Novell
ECH Modula-2       \$ 81         piler Kit       \$ 199         elopment System       199         kit       141         Brook Modula-2       179	c-tree, Faircom
DEVELOPMENT TOOLS	dBC III PLUS  db_VISTA OR db_QUERY, Raima C XQL, Softcraft
lax, Qualitas	

#### Science & Engineering Software

Device Equations Source. Probe graphics post-processor Parts parameter estimator Monte Carlo Analysis Digital Files. Schema II, Omation. smARTWORK, Wintek Corp. Tango PCB, ACCEL Tech Tango Route Tango Schematic Tango Tools	309 399 399 309 449 469 469 279
DATA ACQUISITION/SIGNAL ANALYSI	2,179
Asyst 2.9. \$ Asyst Modules 1, 2, 3 Asyst Modules 1, 2, 4 Asyst Module 1, 2 Asyst Module 1, 2	1,989 1,989 1,609
Asystant GPIB	629
Asýstant DADISP, DSP Systems DADISP-488	749
DADISP-488 Fourier PERSPECTIVE II, Alligator HYPERSIGNAL, Hyperception HYPERSIGNAL Plus. LABTECH Acquire, Lab Tech. Corp	305
LABTECH CHROM	175
LABTECH Notebook, LABTECH Real Time Access, Lotus Measure	269
Lotus Measure QED D.A. and Control, Hart Scientific SNAP-CALC, HEM Data Corp SNAP-FFT	350
SNAPSHOT STORAGE SCOPE UnkelScope Junior, Unkel Software	109
UnkelScope Level 1 UnkelScope Level 2+	315

PLOTTING AND GRAPHING	
ChartBuster PC, Interchart Software\$ Datatap Graph, Milhalisin Assoc. Omniplot, Scientific Endeavors. PC. MAP III, Peerless Engineering PLOTZ, Curtis Technical Soft TECH°GRAPH°PAD, binary engineering.	3E 2E 7E 31 31
EQUATION SOLVERS	

MathCAD 2.0, MathSoft Math Mate, MCAE Technologies. muMATH, Soft Warehouse SolverIT, Structured Scientific Software Solver-Q, SDOC. TK!Solver Plus, Universal Tech Sys.	282 89 189 79 79 379
GAD AutoCAD, by Autodesk Autosketch, by Autodesk Speed Enhanced Version Design CAD, American Small Bus. Comp Drafix 1 Plus, Foresight Drafix 1 Plus, Foresight EASYCAD, Evolution Computing. ECAD, Pelton Engineering FASTCAD, Evolution Computing. Generic CADD Generic CADD Other Generic Software Products In 'A'Vision, Micrografx Windows Draw W/Clip Art Windows Graph. LaserCAD, DSL Link PRO-30/PC, Enabling Technologies	CALL 65 719 2239 1699 1.8649 159 1.169 159 159 169 169 169 169 169 169 169 169 169 16
AUTOCAD ADD-ONS AutoESL, Systems Unlimited of CA	189 89 449 149 5 149
LOGITECH Combos LOGITECH Series 2 Mouse Microsoft Ser or Bus Mouse W/Easy CAD W/MS Windows SUMMAMOUSE, Summagraphics APL-LANGUAGE APL*PLUS/PC, STSC APL*PLUS/PC, STSC APL*PLUS PC TOOLS, POCKET APL	89 99 119 139 99
SCIENTIFICATEXT PROCESSING CHEM-TEXT, Molecular Design Ltd\$ EXACT, Technical Support Software EXP. Brooks/Cole Publishing	18

For Math, Shantha Software Lotus Manuscript PC TEX, Personal TEX T3 Sci. Word Proc., TCI Software Res	379 445 229 499	System ID Toolbox POINT FIVE, Pacific Crest The Professional Wheel, Dalin Inc. Units, Curtis Technical Soft	459 279 199 25
STATISTICS  ABstat, Anderson Bell. \$ CSS, StatSoft. Microstat II, Ecosoft MWA STATPAK, Northwest. P-STAT The Scientific Wheel, Dalin Inc. SPSS/PC + STATS + StatSoft. STATS +, StatSoft. STATS +, StatSoft. STATS + With SYGRAPH.	469 319 359 659 749 539 549 709	FORTRAN L'ANGUAGE  DIFF-E-Q, Microcompatibles	449 131 119 429 445 299 249 119 479 135 279
ADDITIONAL SAE PRODUCTS ATLAS* GRAPHICS, STSC. \$ Atoms, Curtis Technical Soft. COMPEDITOR, Avecolnc. Engineer's Aide, Eng Prog Concepts. LASCAUX 1000 Calculator PC-Matlab, The Math Works Control System Toolbox.	339 25 155 649 55 659 459	GAUSS GAUSS Prog. Lang., Aptech Sys\$ GAUSS Math & Stat System	189 380

	System ID Toolbox POINT FIVE, Pacific Crest The Professional Wheel, Dalin Inc. Units, Curtis Technical Soft	459 279 199 25
	FORTRAN LANGUAGE	
	DIFF-E-Q, Microcompatibles	449 131 119 429 445 299 119 479 135 279
9	GAUSS	
955959	GAUSS Prog. Lang., Aptech Sys\$ GAUSS Math & Stat System	189 380
g	X-ASMS/SIMULATORS	

We accept AMERICAN EX-PRESS, MC, VISA and PERSONAL CHECKS. There PERSONAL CHECKS There is no surcharge on credit card or C 0 0 New York State residents must add sales tax. Shipping and handling \$3.95 per item within the U.S. sent UPS ground Rush and international service available. Call for prevailing rates.

International orders add

Ordering Information

International orders add
\$10 for export preparation.
 Prices and policies may
change without notice
Dealers and Corporate
Buyers call for special
rates.
 Mail orders must include
phone number.

phone number.
• Ask for details before you buy, some manufacturers won't take returns if disk seals are broken

Call for your FREE catalog today!

In the U.S. call 1-800-333-3141

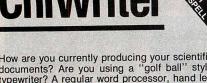
International Orders: 914-332-0756

# SOFTWARE CO.

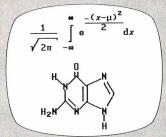
55 South Broadway, Tarrytown, NY 10591

OCTOBER 1988 • B Y T E 115

### **ChiWriter**



How are you currently producing your scientific documents? Are you using a "golf ball" style typewriter? A regular word processor, hand lettering the special symbols? Are you fighting against a "what-you-see-is-definitely-not-what-you-get" system with a special command language? Or are you using one of our competitors' expensive and inflexible programs? Find out how ChiWriter can solve your scientific word processing problems.



From an actual ChiWriter screen display

#### Powerful Scientific/Multifont Word Processing at a Reasonable Price

ChiWriter is a complete word processor, designed especially for scientific and foreign language text. Its features include: intuitive formula editing commands, automatic pagination, variable headers and footers, footnotes, box draw mode, a notepad window, and an integrated spelling checker.

Best of all, ChiWriter is completely "what-you-seeis-what-you-get." Even complicated formulas can be entered easily because the screen display corresponds exactly to the printout.

ChiWriter runs on an IBM PC with CGA graphics, 2 floppy or 1 hard/1 floppy drive, and an Epson/IBM compatible 9 pin printer. Hi res screen suport (Hercules, EGA, VGA, AT&T), 24 pin printer support, and laser printer support (HP LaserJet, PostScript) are available.

In Short: An easy-to-use WYSIWYG package with powerful scientific/multifont word processing at a bargain price.

PC Magazine, July 1988

		-	م ۔	
			75	
Hi Res 24 Pin Laser F Internat Chemis Word P Conogn MergeC	er Program Screen Supp Printer Supprinter Supprinter Support ional Keybo try Support erfect Conv aphic Font S hi Mail Men ii Index Gen g & handlin S. & Canada	port port ort ard Support erter Set ge Facility erator	\$	\$99.95 \$24.95 \$24.95 \$59.95 \$19.95 \$49.95 \$49.95 \$24.95 \$59.95
Name				
Address _				
City				
State	Zip	Coun	itry	
Phone (	) .			
Payment I	y 🗆 Check	☐ Purchase (	Order 🗆 V	'ISA □ MC
Card #			Exp.	/
				B10

Horstmann Software Design Corporation 140 E. San Carlos St./P.O. Box 5039 San Jose, CA 95150-5039, USA (408) 298-0828

horstmann software

#### Items Discussed

Actor\$495 The Whitewater Group Technology Innovation Center 906 University Place Evanston, IL 60201 (312) 491-2370 Inquiry 935.	NewWave
Inquiry 935.	Special Days\$39.95
Choice Words \$99	Footprints in History \$39.95
Proximity Technology, Inc.	The Salinon Corp.
3511 Northeast 22nd Ave.	P.O. Box 31047
Ft. Lauderdale, FL 33308	Dallas, TX 75231
(305) 566-3511	(214) 692-9091
Inquiry 936.	Inquiry 940.
FastTRAP	<b>Sprint</b> \$199.95
serial version\$149	Borland International, Inc.
bus version\$169	1800 Green Hills Rd.
MicroSpeed	P.O. Box 660001
5307 Randall Place	Scotts Valley, CA 95066
Fremont, CA 94538	(408) 438-8400
(415) 490-1403	Inquiry 941.
Inquiry 937.	
	Windows/286 \$99
Lascaux "The Intelligent	Windows/386\$195
Calculator" \$59.95	Microsoft Corp.
Lascaux Graphics	16011 Northeast 36th Way
3220 Steuben Ave.	P.O. Box 97017
Bronx, NY 10467	Redmond, WA 98073
(212) 654-7429	(206) 882-8080
Inquiry 938.	Inquiry 942.

oratories and knows more about gravity and antimatter than anyone except Stephen Hawking and Roger Penrose. He also writes some good science fiction.

One computer book of the month is by Nancy Andrews, Windows from Microsoft Press. Fair warning: it's an "official guide" and therefore glosses over all the problems. I recommend it as a good introduction to what Windows is all about, but if you want to learn about Windows warts and all, you'll have to go elsewhere. The other computer book of the month is by Gerard J. Holzmann, Beyond Photography, the Digital Darkroom from Prentice Hall. It will tell you a lot about what can be done with digital image processing and how to do it. Some of it's amazing. I wonder if photographs will be courtroom evidence any longer.

The game of the month remains Strategic Conquest. We still haven't got it to play on the Mac II, but it goes great guns on the Mac Plus. The game of the month would have been F/A-18 Interceptor from Electronic Arts for the Amiga, but there was a problem. Once in a while

someone gets lucky and gets to play the game, but most of us can't get past the crazy code-wheel "security" system. It's far more complicated than the game itself. I might even prefer copy protection, except that Electronic Arts is the outfit that had a scheme for the Commodore 64 that caused the machine to bash its disk drives out of alignment. Heaven knows what they could do to an Amiga. We'll tell you more about F/A-18 Interceptor when we can find a cryptographer to help us with their code wheel.

Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also earns a comfortable living writing about computers present and future. Jerry welcomes readers' comments and opinions. Send a self-addressed, stamped envelope to Jerry Pournelle, c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Please put your address on the letter as well as on the envelope. Due to the high volume of letters, Jerry cannot guarantee a personal reply. You can also contact him on BIX as "jerryp."





Looking for a

#### **Personal** Information Manager?

"Look no further . . PC-OUTLINE plus is the one to buy!"

PC Week

PC-Outline Plus is an intuitive tool that manages words, projects, thoughts, ideas, people and, yes
...your productivity.
With astounding efficiency,

speed and ease!

PC-Outline Plus It thinks of things you're too busy to think of.

For instance, putting random information in its right place.

It does to ideas, tasks and projects what spreadsheets do to numbers.

The text editing features are so powerful you can actually use PC-Outline Plus as your pop-up word processor! Here are just a few of the many features that make PC-Outline Plus

"the one to buy":

- Powerful Word Processor capabilities
- Outlining features
- Project manager
- Category view/sort option

  WordPerfect® WordStar® & Auto save
  MS Word® user-interfaces And MOI FREE and TOLLFREE
- support for 1 year
- 9 windows
- Prioritizing ■ Macros
- Memory Resident
- And MORE!





We call this feature "Hide & Show." You'll call it a godsend. With the touch of a key, suddenly an outline shows only the essential points. One keystroke will reveal the details again.

\*Our ShareWare versions are older versions of the product, but are full-featured & fully-functional and yours to try for a FREE 30 day evaluation period.

© Copyright 1988 Brown Bag Software, Campbell CA 95008

#### A little skeptical?

Get a copy of PC-Outline to try for 30 days. (And while you're at it, pass copies around to your friends and associates for their evaluation.) If not totally sold on us, don't pay us a cent.'

No risk. No hassles. No fooling! (This free 30 day evaluation period is available on all Brown Bag Software® products.)

#### Lotus®? Load US!

Quantity discount and site licenses available. To order call:

#### 800-523-0764

In California, call (408) 559-4545. Introductory Price: 195 (750 shipping & handling CA residents add sales tax) Brown Bag Software® File #41719, Box 60000 San Francisco, CA 94160-1719



#### State-Of-The-Smart.™

Offices in London 01 831 1106— Köln 0221 7710923—Copenhagen 01 933837-Amsterdam 020 233408—Zürich 01 2146224

#### THE NEW STANDARD FOR **HIGH PERFORMANCE** STATISTICAL SOFTWARE

#### **COMPLETE STATISTICAL SYSTEM**

WITH DATA BASE MANAGEMENT

#### **AND GRAPHICS**

A powerful, comprehensive, elegant, and super-fast statistical package for IBM (PC, AT, PS/2) and compatible computers. The CSS optimized user interface with fast hierarchical menus incorporates elements of artificial intelligence; even complex analyses require only a few keystrokes (batch processing is also supported). CSS features comprehensive, state of the art implementations of: Basic statistics, Multi-way frequency tables, Nonparametric statistics, Exploratory data analysis with analytic graphs, Multiple regression methods, Time series analysis with modeling and forecasting (incl. full ARIMA), General ANOVA/ANCOVA/ MANOVA, Contrast analysis, Discriminant function analysis, Factor analysis, Principal components, Multidimensional scaling, Item analysis/Reliability, Log-linear analysis, Cluster analysis, Non-linear estimation, Logit/ Probit analysis, Canonical analysis, Survival and Failure Time analysis (Censored data), Quality Control analysis, and much more. All statistical procedures are integrated with fast data base management and instant, presentation quality graphics (over 100 types); full support for all mono and color graphics boards (incl. VGA) and over 100 plotters and printers (incl. the HP and Postscript standards). All CSS screen output is displayed via customized Scrollsheets™ (i.e., dynamic, user controlled, multi-layered tables with cells expandable into pop-up windows); all numbers in a Scrollsheet<sup>TM</sup> can be instantly converted into a variety of presentation quality graphs; contents of different Scrollsheets<sup>™</sup> can be instantly aggregated, combined, compared, plotted, printed, or saved. The flexibility of the CSS input/ output is practically unlimited: CSS offers an intelligent interface (read/write) to all common file formats (Lotus, Symphony, dBII, dBIII +, DIF, SYLK, ...) and special utilities to easily access data from incompatible programs; graphics can be saved in files compatible with desktop publishing programs (Aldus, Ventura). CSS data files can be as large as your operating system (DOS) allows; OS/2 version coming soon. CSS precision exceeds the standards of all common precision benchmarks. Technical note: The CSS user interface and all I/O were written in Assembler and bypass DOS; graphics and data management were written in Assembler and C; the computational algorithms were written in Assembler and optimized Fortran. 

\$495 (plus \$5 sh/h); 14-day money back guarantee.

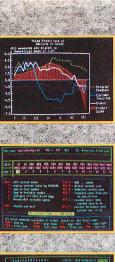
Circle 246 on Reader Service Card



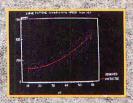
2325 East 13th Street = Tulsa, OK 74104 = (918) 583-4149

Fax: (918) 583-4376

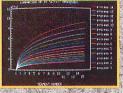
Overseas Offices: StatSoft of Europe (Hamburg, FRG), ph: 040/4200347







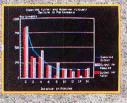




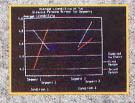


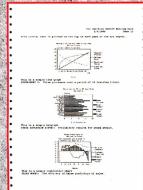






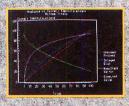


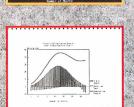


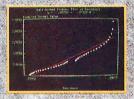














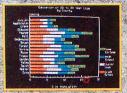














## **SPRINT** WITH CAUTION

Borland's new word processor doesn't live up to Ezra's expectations; plus, more on projectmanagement software

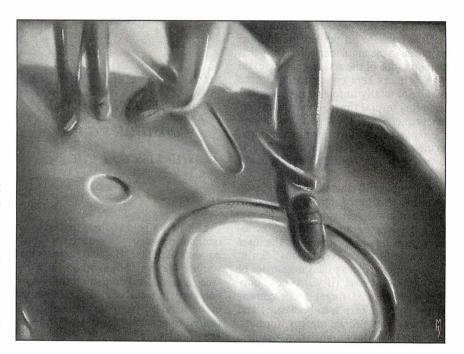
hen Lotus announced that it was pulling the plug on Modern Jazz for the Macintosh, I was somewhat disappointed. The Mac universe could use another strong integrated product; I'd been hoping that the program would be a worthy challenger to Microsoft Works. However, it takes guts (not to mention financial stability) to do what Lotus did, and there's a lot of merit in abandoning a product that simply doesn't measure up, even if it means discarding years of labor and a significant cash investment. Though Lotus has taken heat for its inability to bring Modern Jazz to market, you have to admire the company's commitment to quality. It has sent a strong, comforting message to its customerspast, present, and future.

I am far less troubled than I used to be by companies that fail to meet their announced shipping dates. If it takes a few extra weeks or months to deliver a product that's bug-free and reliable, the wait is a minor inconvenience. I'd rather lose time than data.

But what can be said about big firms that release substandard products? What does it say about their attitude toward their customers? Something to think about, isn't it?

#### Too Much, Too Late

Sprint: The Professional Word Processor (Borland International, \$199.95) should have been a winner. The theoretical appeal of the program is unquestionable:



You're promised an editor with powerful formatting capabilities, a selection of user interfaces, and one of the most extensive macro languages ever devised. The price is quite reasonable for a fullfeatured word processor. And it comes from the company that brings us such jewels as SideKick, Reflex, and Paradox, all of which rank among my favorite programs.

Unfortunately, Sprint is nothing to write home about. It doesn't qualify as a total disaster, but cosmetics are slipshod, and Sprint's most highly touted feature—the ability to switch among a halfdozen "user interfaces"-is far less impressive than Borland's advertising would have you believe. The product seems somehow strangely unfinished; I couldn't escape the sense that I was working with a programmers' prototype rather than with a final release. The menus are unappetizing lists of commands that pop up gracelessly; Borland has given us better-looking word pro-

cessing in both SideKick and the Turbo Pascal Editor Toolbox.

I was disappointed with Sprint. Though I've tried for over a month to develop some affection for it, I just can't do it. I've come to expect miracles from Philippe Kahn; perhaps I was simply demanding more from Sprint than any MS-DOS word processor could ever give me.

Installation starts out looking easy but turns into a headache. The Setup program opens with a menu that suggests a pleasantly mindless cruise through a series of configuration options. The numbers on Sprint's 11 disks have little to do with the sequence in which their contents are loaded; I had to do a mad dance of disk shuffling.

After installing the main program modules, the Setup program asks if you'd like to have it modify your AUTO-EXEC.BAT and CONFIG.SYS files without telling you what it intends to do to them (a practice I despise); you can opt to have

it make the changes or to copy examples of the two files into your Sprint directory. Since I'm wild about punishment, I decided to let it make the modifications. Instead, the program gave me the examples. When I went back and requested examples, hoping to get the changes, it gave me the examples again.

All hell broke loose when I got to the printer-installation segment. I selected an option that would let me specify the port to which my printer was attached, and found myself locked in an endless loop in which the program kept requesting the Setup disk and refusing to recognize that the disk was, indeed, in drive A. I was able to hit the Escape key and exit back to the main menu, but from that point on, one of the screens having to do with printers kept on appearing in the middle of totally unrelated operations. I tried this several times, choosing different printers, and the result was always the same. I could have Sprint send output to the standard PRN device or to a file; if I wanted to pick a port, I was flat out of luck. Ouch.

After about 10 runs through the Setup program, I figured Sprint was as installed as it was ever going to be. Choosing to let the program give me the dictionary, the thesaurus, and all the user interfaces and file conversions, Sprint was occupying close to 2.5 megabytes of my hard disk drive. (If you choose only one interface and forget about conversions, you can keep it to between 1 and 1.5 megabytes.) Since macros, formats, interfaces, overlays, translation routines, printer definitions, dictionaries, and suchlike are all separate files, I had 59 entries in my directory. I refuse to think about using this program without a hard disk drive.

Anyway, I plowed on without giving the manual more than a quick skim. After all, I know many word processors, right? Sprint unceremoniously flashed a brief copyright notice and dropped me directly into the editing screen of the advanced Borland interface: ruler at the top, status line at the bottom, and not the slightest hint of how to do anything further. A quick check of the reference card led me to the F10 key, and I brought up the main menu. I was amazed to discover that on my EGA monitor/video card combination, the initial letters on the menu, which can be used to invoke commands, were highlighted in white on white. I found the Customize menu, changed the colors to something readable, and loaded the WordStar interface, with which I thought I'd be more at ease.

What I See Is Not What I Expected to Get

Borland and I have a difference of opinion on what constitutes a user interface, I guess, because I was expecting to see a screen that looked like good old Word-Star. What I got was a screen that looked like the good old advanced Borland interface. No visible difference. And typing the WordStar Control-key command prefixes brought up menus along the right side of the screen, in exactly the same position the Borland interface uses.

and I have a difference of opinion on what constitutes a user interface, I guess.

I hit F1 for help and was treated to an ominous message: "If you are not familiar with WordStar, Borland suggests that you use the more powerful Sprint interface instead." I didn't think this was a good way to instill confidence, but most of the standard WordStar commands appeared to be available, so I began to do some editing.

I typed a few words and then tried to use the arrow keys to back up and correct a couple of typing mistakes. Couldn't do it; the cursor was frozen in place at the end of the line. I had no idea if I had done something wrong or if Sprint was in the process of crashing, but I started punching Control and function keys at random to see if I could produce a response. Nothing but an occasional beep. At that point, I went off and made myself a cup

When I returned, the cursor had moved to the front end of the line, and a string of K's stretched off the right side of the screen. I tried WordStar commands and cursor keys to move along the line, but they didn't do anything. The uparrow key worked, however, and I moved up to the ruler line, which I was able to delete, much to my surprise. Then, since I had magically regained access to the help screen, I moved from there to the main Sprint menu and tried to reload the advanced Borland interface. I wanted to see if the cursor would start moving in a

different environment.

I accomplished the interface shift, but the text vanished. So much for the autosave feature that protects you from data loss if you stop typing for a few seconds. Needless to say, I have not been able to replicate this experience, although in subsequent trials with the WordStar interface, I've managed to lose large chunks of text without knowing why.

I then spent a few hours reading the documentation, which is both exhaustive and exhausting. The manuals are perfect-bound, which means broken spines if you try to flatten them out, and printed in dense black type. The word "unrelenting" springs to mind.

The next time I tried the program, I went with the Microsoft Word interface. Yes, it looked exactly like the advanced Borland interface, but the menus employed Word's command set. When I began typing, Sprint put in all the symbols Word uses to indicate spaces, returns, tabs, and suchlike. I was impressed until I switched back to pure Borland and noticed that the funny symbols didn't go away. It turns out that loading the Word interface sets preference options that determine the appearance of your text, but the other interfaces aren't bright enough to look for the same options and reset

OK. Having had my fill of the imitative interfaces, I did the rest of my testing in Borland mode. On my Tandon PC AT clone, the program was certainly fast enough for me, even throttled down to 6 MHz. Block moves, margin changes, spelling checking, and basic editing operations were quite acceptable, and I hummed along contentedly for a while. As I began to try out more sophisticated features, though, I encountered a series of oddities inherent to Sprint's design.

You can have as many as 24 files open at any one time, with up to 6 appearing simultaneously on-screen. That's nice, until you discover that windows are horizontal only. Forget side-by-side comparisons of narrow columns; can't be done. Windows stretch the full width of the screen, and each displays a status line at the bottom. Let's see: If you try for the maximum of 6 windows on a standard 25-line display, that's 6 lines deducted for status information, leaving you 19 lines to be divided six ways. Unless you can do something useful with 2- and 3line windows, you'd better forget the maximum and plan for only 3 or 4 files open on the screen.

According to the documentation, you can do complex formatting, like creating

continued



## FIMERYERAN

**OUTSIDE USA----CALL** 18)692-007

FOR CUSTOMER SERVICE Call Mon-Fri:9:30am-4:30pm (718) 692-1148

Retail Outlet: Penn Station, Main Concourse (Beneath Madison Square Garden) NYC,N,Y,10001 Store Hours: Mon-Fri 8:30-8/Sát-Sun 9:30-7

FOR ORDERS & INFORMATION CALL TOLL FREE

**OR WRITE TO: Montgomery Grant Mail Order Dept.** P.O. Box 58 Brooklyn, NY 11230

FAX NO. 7186923372 TELEX 422132 MGRANT

OPEN 7 DAYS A WEEK FOR ORDERS: Monday-Friday9am-7:30pm/Saturday & Sunday 9:30am-6pm (EDT) NO SURCHARGE FOR CREDIT CARD ORDERS / WE INVITE CORPORATE & EDUCATIONAL CUSTOMERS CORPORATE LEASING AVAILABLE

#### LAPTOPS



AMSTRAD PPC-640 SD

640 K 720 K Floppy Drive Built-in 2400 Baud Modem

<b>NEC MULTISPEED</b>	EL\$1	299
<b>NEC MULTISPEED</b>		
<b>NEC MULTISPEED</b>		

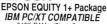
TOSHIBA 1000	\$729
TOSHIBA 1200 H	
TOSHIBA 3100/20	
TOSHIBA 3200	
TOSHIBA 5100	

ZENITH 184 SUPERSPORTS
W/ 2FLOPPYS\$1469
ZENITH 184-2 SUPERSPORTS
W/ 20MB\$2199

SPARK by DATAVUE 640K w/2 720K DRIVES..... .\$949 SPARK EL.....\$1099

MODEMS, EXTERNAL DRIVES & ACCESSORIES available for all laptops

#### **EPSON**



 640K RAM w/Clock Calenda 360K Drive · Keyboard · Serial & Parallel Ports · 12" High Resolu-tion Monitor · Box of 10 Diskettes

\$769

Same Pkg. w/One Floppy \$ 1029 Same Pkg. w/Two 360K \$849

**EPSON EQUITY III+** 40 MB Hard Drive Package IBM AT Compatible

Keyboard -80286 Proccessor 640K RAM-6/8/10 MHz -1 2 MB Floppy Drive -40 MB Hard Drive 12" Monitor -8 Expansion Slots Serial and Parallel Ports



<sup>\$</sup> 1899

**EPSON EQUITY II+** IBM AT Compatible Hard Drive Package

Keyboard · 640K RAM · 80286 Microprocessor · 1.2 MB Floppy Drive · 20 MB Hard Drive · Mono Monitor

LOGITECH MOUSE M-7 \$59.95 We Can Reconfigure Any Of Our Computer Packages To Your Specifications. Call For Information. We Carry Modems, Drives, Cards,



#### Hard Drive Package

· IBM XT Computer · IBM Keyboard 256K RAM Expandable to 640K · 360K Disk Drive 20MB Hard Drive • Package of 10 Diskettes (Monitor Optional)

1199 \$

IBM XT Package with 2 360K Floppy Drives



1 MB RAM 80386 16 MHz Microproccessor 1.2 MB Floppy Drive 40 MB Hard Drive 3 Expansion Slots - Enhanced Keyboard Serial & Parallel Ports 12" Monitor

\$2699

À.:

13

**NEC**° PowerMate 1 IBM PC/XT/AT COMPATIBLE **PACKAGE** - 800286 10 MHz Processor 640K RAM-1.2 MB Floppy Drive 12" Monitor \$1249

W ... Same Package with NEC 20 MB Hard Drive





SEAGATE 20,30,40,60,80 MB HARD DRIVES IN STOCK

#### commodore

128 PACKAGE

Commodore 128 Computer - Commodore 1571 Disk Drive Commodore 1902 Color BGB Monlitor Commodore 1515 Column Printer \$

Commodore 64/c Computer - Commodore 1541 Disk Drive · Computer Printer \$399 - 12" Computer Monito



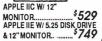
Rush Service Available **Call For Details** 

Circle 178 on Reader Service Card

#### **PACKAGES**

1379

Color Monitors & All Other Accessories For Your Computer.



atapple

Apple IIGS Computer 3.5" Disk Drive Apple RGB Color Monitor Package of 10 Diskettes All Cables & Adaptors Package of 10 Diskettes Apple Software

MAC PLUS Computer Package	\$1279
IMAGEWRITER [] Pinter	\$449
IMAGEWRITER LQ	
MAC SE Computer w/ Dual Drive	\$1949
MAC SE Computer w/20MB APPLE	
Hard Drive	\$2599
APPLEMACII w/ Keyboard	\$2799

#### **PRINTERS**

EPSON	PANASONIC
X-1050 \$489.95 X-850 \$349.95 Q-500 \$315.95 Q-800 \$229.95 Q-850 \$509.95 Q-1050 \$709.95 Q-2500 \$829.95 X-800 \$419.95 X-800 \$199.95	1080i-II. \$159 1092i. \$291 1091i-II. \$189 KXP-1524. \$499 KXP-1595. \$409 KXP-4450 Laser.\$1 TOSHIBA 321-SL. \$449 341-SL. \$629
	341-SL\$6

AMIGA 500 Computer w/ 1084 \$999 Monitor &1010 3.5" Floppy Drive

ALL PERIPHERALS IN STOCK

AMIGA 2000 IN STOCK

MIG/

AMIGA 500 Computer w/\$

VENDEX HEADSTART

10 MHz Dual Floppy Drives 7

Apansion Slots - 512K Expandable to 768K - Parallel & Serial Ports

to 768K - Parallel & Serial Ports Mouse - Available in Colo or Mono System. - Over \$1000 Worth of Software - NO CHARGE!

1084 RGB Monitor

#### LEADING EDGE MODEL D Package IBM PC/XT Compatible

512K RAM Keyboard 4.7-7.16 MHz. 360K Floppy Drive Monitor 8088-2 Precessor

Same Package w/ 20MB \$989 Hard Drive

Same Package w/ 30MB \$ 1039 Hard Drive

**OKIDATA** 

OKI-120......\$189.95 Okimate 20...\$119.95 Okidata 180...\$219.95 Okidata 183...\$299.95

NEC

\$339.95

#### PRINTERS STAR

NX-1000

95	
95	
95	
95	
95	
49	

er.\$15 IRA ..\$449.95 ..\$629.95 commodore

IBM PC/XT

Compatible

RAINBOW	\$219.95
NX-1000	\$169.95
NX-15	\$299.95
NX-2400	\$339.95
NB-2410	\$409.95

Citizen Printers IN STOCK

Diconix Printer For Laptops.....\$289.95

#### **AMIGA 2000** IBM PC/XT COMPATIBLE RGB COLOR PACKAGE



· A-2000 Computer w/ Keyboard 1 MB Exp. to 9 MB Built-in 3.5" D. Dr. RGB Color Monitor 2088 iBM Compat. Bridge Card w/5.25" Floppy Disk Drive

INCLUDES FREE MOUSE AND SOFTWARE

#### PERSONAL SYSTEM 2 MODEL 50

640 K RAM 1.44MB Floupy Drive 20 MB Hard Drive

Monitor Optional





Laserjet \$1629 SeriesII \$1629

1 MB Expander.\$349 HP DESKJET PRINTER.\$719

#### LEADING EDGE D2

IBM AT COMPATIBLE 20MB HARD DRIVE PKG. Keyboard 1.2MB Floppy 20MB Hard Drive 80286 Processor 12" Mono Moni-

\$ 1499

Same Package w/ 30 MB\$ 1549

#### **NEW** PC1640

Keyboard 640K RAM Turbo Speed 1 360K Drive Mono Monitor Free Mouse & Software

\$649

\$899 w/ 20MB.....

#### commodore COLT IBM PC/XT COMPAT. PACKAGE



Keyboard Two 360K Floppy Two 360K Flopp Drives Serial & parallel orts Mono Monitor MS DOS

#### commodore

PC10-1 PC10-IBM PC/XT Compatible PACKAGE

- PC10-1 Computer - 512K RAM Expandable to 640K - 360K Disk Drive Enhanced Keyboard Serial & Parallel Ports - 12" Monitor - AC Adaptors - All Hook-up Cables - Pkg. of 10 Diskettes

\$499

Same Package with \$749

\$999

NO ADDITIONAL SURCHARGE FOR CREDIT CARD ORDERS WE WELCOME CORPORATE & EDUCATIONAL ACCOUNTS



#### People are talking about us.

"Lahey specializes in FORTRAN Language Systems."

"Lahey has the fastest compilation speed." "Lahey has the most mainframe extensions."

"Lahey has the best diagnostics." "Lahey has a quick and easy to use debugger."

"Lahey has technical support you can count on." "Lahey is rated #1 by reviewers."

"Lahey has a compiler for every FORTRAN user."



Contact us to discuss our products and your needs. (800) 548-4778 Lahey Computer Systems, Inc. P.O. Box 6091, Incline Village, NV 89450 Tel: (702) 831-2500 FAX: (702) 831-8123 Tlx: 9102401256

numbered lists, multiple columns, or indented outlines. In practice, because Sprint is not a WYSIWYG program, every time you try something fancy, you're flying blind.

The outline feature is a good case in point. Each time you want to indent a new sublevel, you have to insert the Sprint formatting command BEGIN OUTLINE, which appears as highlighted text. And for every BEGIN OUTLINE, you must provide a matching END OUTLINE command. A standard outline quickly begins to look like a Pascal program (although

time you try something fancy, you're flying blind.

flush left), with your lines and Sprint's commands interspersed. It's pretty easy to lose track of where you are because no information appears to tell you anything about position. Numbering is automatically generated to go with the indents, but only at print time; you can't see either indents or numbers while you're editing.

You can get a rough idea of what's happening by calling up Sprint's pagepreview mode, which runs your text through the independent formatting program and displays the result. You can't edit while looking at the formatted version, and the documentation warns you that what you're viewing is only an approximation of the final output.

Sprint is an old-fashioned word processor; editing and formatting are accomplished by two separate programs. The editor has additional code to allow it to act as a shell for the formatter, but the two programs don't interact much. As an example, you don't see dynamic page breaks displayed by the editor; that's the formatter's job. The editor doesn't understand much about pages.

If you want to get an idea of how things are breaking, you can push the text through the formatter, which will place visible breaks in the file. These breaks won't respond to any changes you make to the text later; if you do some editing, you have to issue another repaginate

continued

## THE "DESKTOP PRESENTER PACK"



## Everything you need for creating and giving presentations with your PC.

Now, you can make impressive, professional-quality, full-color presentations of any kind right at your desk with The DESKTOP PRESENTER PACK.

Everything you need is included: Colormetric® a high resolution graphics card for your PC, PictureIt™ business graphics software, and PCPrintmaker® desktop printing software.

With The DESKTOP PRESENTER PACK you will turn your personal computer into a full-capability workstation for creating professional-

quality presentations quickly and easily. Then use your PC to give a video presentation in 1000 colors.

Or make high resolution slides, overhead transparencies or hardcopy all in full-color by simply plugging in a SlideMaker® or color printer.

Buy the DESKTOP PRESENTER PACK and make the best presentation of your career.

Call today 800-556-1234, ext. 234. In Calif. 800-441-2345, ext. 234.

General Parametrics Corporation the makers of VideoShow

#### 2110 ODUCTS

For PCs and compatibles SYNTHESIZER—only \$79.95



The next versatile and best sounding speech product available for under \$4000! The amazing Speech Thing provides text-tospeech as well as PCM and ADPCM speech and music reproduction. Comes with "Thing" D/A converter that attaches to the parallel printer port outside the computer-ideal for laptops. Will not interfere with normal printer operation. Also comes with audio amplifier/speaker and power adapter. Software includes two advanced text-to-speech programs, digitized speech and music files, full screen waveform editor, sampling music keyboard, special effects mixing board, and drivers so you can add speech and sound effects to programs written in BASIC, C, PASCAL, and others. Includes 54 page manual. SPEECH THING-\$79.95.

#### DIGITIZER—only \$89.95



The Voice Master PC Digitizer is a full 8-bit PCM sampler board. Fits in any available slot. Up to 15,000 samples per second. Input pre-amp has automatic gain control and 4.5 Khz low pass filter. Includes a quality headset microphone. Software included for recording and editing sound files for playback through Speech Thing. Also includes a real-time spectrum display and oscilloscope display as well as assembly language source listings for writing your own drivers. BONUS: Voice recognition program included which is callable via an interrupt vector. Demonstration program written in GWBASIC. VOICE MASTER PC DIGITIZER—\$89.95.

#### VOICE RECOGNITION only \$49.95



A price/performance break-through! Equal in performance to other systems costing hundreds more \$\$\$. The amazing Voice Master Key program adds voice recognition to just about any program or application. You can voice command up to 256 keyboard macros. Fully TSR and occupies less than 64K. Instant response time and high recognition accuracy. Easy and fun to use—no compilers or editors required. Works with CAD, desktop publishing, word processor, spread sheet, even other TSR programs. A genuine productivity enhancer. Voice Master Key can also be called from within a program for adding voice recognition to custom applications. Voice Master Key requires the Voice Master PC Digitizer for operation. (Please note: Voice Master Key will not replace the keyboard or mouse except under certain circum stances. Not to be confused with the still unavailable "voice typewriter.") VOICE MASTER KEY-\$49.95.

BONUS OFFER! Buy Voice Master Key with PC Digitizer for only \$129.95-you save \$10!

BETTER BONUS OFFER! Buy all three: Speech Thing, PC Digitizer, and Voice Master Key for only \$189.95—you save \$20!
ALL OF THESE PRODUCTS ARE OF PROFESSIONAL QUALITY.

ORDER HOTLINE: (503) 342-1271 Monday-Friday, 8 AM to 5 PM Pacific Time

Add \$5 for shipping and handling on all orders. Add an additional \$3 for 2nd day delivery. All goods shipped UPS. Master Card and VISA, money order, cashiers check or personal checks accepted (allow a 3 week shipping delay when paying by personal check). Foreign inquiries contact Covox for C&F price quotes. Specify computer type when ordering. 30 DAY MONEY BACK GUARAN-TEE IF NOT COMPLETELY SATISFIED. ONE YEAR WARRANTY ON HARDWARE.

Call or write for FREE product catalog.



COVOX INC. 675-D CONGER ST. EUGENE, OREGON 97402 U.S.A. TEL: 503-342-1271 FAX: 503-342-1283

command to relocate the breaks in the file. If you're used to any sort of dynamic formatting (as is found in most other word processors), this is awkward and confusing.

Should you make a mistake entering formatting commands, like forgetting to supply a matching END command for each BEGIN command, you won't find out about it until you run the formatter, either for preview or printout. The effect is like trying to write a program for a compiler without the advantage of a debugger.

#### Lots of Power; Who's It For?

True, Sprint has a lot of power. If you like to program, you can generate editing macros that will do just about anything you've ever wanted to do in a word processing program. The language is thorough and extensive, and it looks a bit like C. You can perform complicated search and replace operations, manipulate files,

question about Sprint is: Who is this program for?

and even create new command sets (the user interfaces were all written as macros). There's some slight performance degradation when using macros as opposed to native commands, but it's barely noticeable on an AT-class machine. Similarly, you can program the formatter with a terse, often cryptic formatting language. Commands can reside within your document or in independent "style sheet" files that get sucked in when you run the formatter.

The resulting flexibility is marvelous, but determining how to make Sprint do its tricks is severely hampered by the documentation, which seems to be written mostly for programmers. Longer tutorials would help, particularly for writing macros. Code samples in the manuals are few and short, and the discussion of macro programming techniques is limited to 30 pages.

You do get a good selection of features with Sprint, including excellent spelling correction, a large thesaurus, mail merge, a huge amount of context-sensitive on-line help, good printer support, and the auto-save feature that kicks in when you've left the keyboard idle for a few seconds, but you can get those features elsewhere—which leads to my major question about Sprint: Who is this program for?

I'm not convinced that Sprint is the right tool for novices, though Borland assures me that its interface was carefully developed to appeal to new users. Intermediate users and those used to WYSIWYG will be thrown for a loop. Programmers (who'd appreciate the macro capabilities) would be just as satisfied with Pmate, MultiEdit, or the editor/debugger combos that come with most programming environments. That leaves Sprint appealing to an odd subset of the word processing world.

I accept Borland's contention that it serves the needs of offices that want chameleon interfaces for part-time and temporary employees used to other programs. For anyone else, the collection of surrogate interfaces is merely a transitional pathway into Sprint.

Borland includes an eye-opening pamphlet that details the ways in which its implementations of the interfaces differ from the originals; each interface gets two or three terse pages of exceptions and exclusions. And if you're going to do anything with macros or complex formatting, you're going to have to learn Sprint anyhow.

The program also seems well suited to environments that need heavy-duty formatting for long, complex documents that include many different types of materials. Encyclopedias, almanacs, technical training manuals, and software documentation would be perfect uses for the package. So Sprint would be excellent as the choice for word processing at (surprise!) Borland itself.

So here's a modest proposal: Since Sprint would seem to be a program designed by Borland for Borland, let's let Borland use it.

#### **Project Mismanagement**

Recently, I received a delightful letter from Hugh Roth on the subject of project-management software. Hugh has been battling several programs for the past few months, trying to develop scheduling systems for book publishing. The letter was long, articulate, and thought-provoking. With his permission, I've extracted a few of his key points; they're worth remembering if you're attempting to pick your way through the mine field of conflicting claims and in-

#### **Aztec C**

Power to go the distance... Whatever that distance might be

From real time embedded applications to comprehensive commercial applications on Macintosh, IBM PC, Amiga, Atari, and others, Aztec C has earned a well-deserved reputation as an innovative, tough to beat, rock-solid C development system.

But don't just take our word for it—try it yourself. We know that the best way to understand what puts you ahead with Aztec C is to use it. That's why Aztec C

systems purchased directly from Manx come with a 30-day, no questions asked, satisfaction guarantee. Call for yours today.

We can also send you information that details the special features and options of Aztec C. Plus information on support software, extended technical support options, and all of the services and specialized support that you may need when you're pushing your software to the limits and ... beyond.

#### **Aztec C Micro Systems**

Aztec C is available for most microcomputers in three configurations: The Professional; The Developer; and The Commercial system. All systems are upgradable.

Aztec C68k/Am .... Amiga source debugger-optional

AZTEC

Aztec C68k/Mac ... Macintosh MPW and MAC II support

Aztec C86 ..... MS-DOS source debugger • CP/M libraries

The following have special pricing and configurations. Call for details.

Aztec C68k/At ..... Atari ST Aztec C80 ..... CP/M-80 Aztec C65 ..... Apple II & II GS

#### Standard System ..... \$199

- C compiler
- Macro Assembler
- overlay linker with librarian
- debugger
- UNIX and other libraries
- utilities

#### Developer System ..... \$299

- all Standard System features
- UNIX utilities make, diff, grep
- UNIX vi editor

#### Commercial System ..... \$499

- all Developer features
- source for run time libraries
- one year of updates

#### **MS-DOS Hosted ROM Development Systems**

Host + Target: \$750 Additional Targets: \$500

#### Targets:

- 6502 family
- 8080-8085-Z80-Z180-64180
- 8088-8086-80186-80286/8087-80287
- 68000-68010-68020/68881

#### Components:

- C compiler for host and target
- Assembler for host and target
- linker and librarian
- Unix utilities make, diff, grep
- Unix vi editor
- debugger
- download support

#### Features:

- Complete development system
- Fast development times
- Prototype and debug non-specific code under MS-DOS
- Compilers produce modifiable assembler output, support inline assembly, and will link with assembly modules
- Support for INTEL hex, S record, and other formats
- source for UNIX run time library
- processor dependent features
- source for startup



C.O.D., VISA, MasterCard, American Express, wire (domestic and international), and terms are available. One and two day delivery available for all domestic and most international destinations.

Manx Software Systems One Industrial Way Eatontown, NJ 07724

Aztec C is available on a thirty-day money back guarantee. Call now and find out why over 50,000 users give Aztec C one of the highest user-satisfaction ratings in the industry.

1-800-221-0440

In NJ or outside the USA. call 201-542-2121

Telex: 4995812 Fax 201-542-8386

#### APPLICATIONS PLUS

#### **Importers:** It's time to change bad habits.

- Don't think Germans offer high quality only at high prices.
- Don't limit your market survey to Asian products.
- Don't forget to order our catalogue.

Printer Buffer inside cable. For the average user, most buffers are too complicated. So we designed a buffered cable with 64K or 256K inside. Just a cable. As easy to use. Nearly as inexpensive.



#### Take out your data.

In a battery-operated buffer. Up to 128K with parallel or RS232-input. Battery will hold data for as long as 3 years. Record and play as often as you like. Carry data to a printer or to another computer.



Share your printer.

Forget these boxes that occupy lot of your desk space. Forget the times when you had to switch manually. We have a cable that allows two computers share one printer automatically.



That's how T-switches should look like!

For IBM-compatibles. 2 printers to one computer. Complete set incl. all cables and a small switch-box.



No bulky box on your desk! Isolating line drivers

If a line driver is not optically isolating, you might face problems arising from different mains supplies. That's why our RS232drivers are 100% isolated up to 1000 volts.



#### Data isolators

Transients on the mains supply or electrostatical discharges can cause erraneous data transmissions and even destruction of computers. We offer optical isolators.



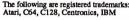
#### Terminal bus.

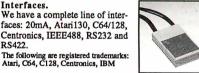
Connect up to 16 terminals to one 2-wire bus. Save installation costs and gain flexibility and ease of use. MUX-BUS includes optically isolated line drivers.



#### Interfaces.

We have a complete line of interfaces: 20mA, Atari130, C64/128, Centronics, IEEE488, RS232 and RS422.





Austria: France: Switzerland: USA:

Zahrer, Wien Neol, Strassbourg Weber&Co, Zürich Tectrans, L.A.

0222-347671 (88) 623752 01-9302003 (818) 2853121

Manufacturer and Exporter:

d-5600 wuppertal 2

west-germany

#### wiesemann & theis gmbh

MIKROCOMPUTERTECHNIK winchenbachstr. 3-5

telex:

fax:

phone: 202-505077 859 16 56 202-511050



comprehensible specifications that characterize this peculiar niche of the software world.

Like many of us, Hugh sees a desperate need for good project-management tools. "Everywhere in business," he writes, "thousands of essentially unrelated dates are pumped into spreadsheets and databases and then pumped out as schedules. Garbage. One date has no relation to another unless there's some hard code behind the data." Yet most commercial packages are overly complex and, as a result, are rarely used.

Hugh cites poor handling of "tasks without resources that are based on time, rather than resource availability. You can kludge your way around this, but who wants to? The classic case is curing concrete. A certain number of calendar days must pass, independent of any resource. You can bet that most packages will not show the concrete curing on the weekend!"

He also blasts a tendency to assign unrealistic starting dates to tasks without precedents. Let's say your project has one isolated task that must be completed before the end of the second month, and it doesn't depend on any other resource used elsewhere in the project. "Most packages will show the task as starting when the project starts. Where is the person in business so virtuous or so unbusy that he can start a task 50 days early? This is a real flaw, or maybe the programmers don't want to fix it because it means several iterations of the calculation algorithm each time you calculate the schedule. The critical path must first be established, then tasks like this have to be calculated backward.'

But the most disturbing points he raises relate to the overall design philosophy of project-management programs. "The general outlook of the packages is that a department does a few projects, each with a different set of resources, and these projects rarely overlap. Who wants to learn [the programs] for just a few projects?

The place where you need the power is where you have many projects drawing on a common resource pool. You need to be able to keep each resources calendar up to date and have any changes reflected in the individual projects. If one supplier goes on strike, and I have 50 projects that use this supplier, what do I have to do? Open and load 50 DOS files and scroll to the correct calendar and change it? Yuck!

'The other place that most packages fail is in cross-project reporting. When a department has 250 projects to traffic

#### Item Discussed

Sprint ......\$199.95 Borland International, Inc. 1700 Greenhills Rd. Scotts Valley, CA 95066 (408) 439-1060 Inquiry 934.

and develop, 250 individual schedules don't do too much good if I'm a supervisor and I've got one person out sick and another on vacation. I need to know, 'What do I gotta get out this week?' I know this is a tough problem. The 640Kbyte barrier owns part of it, but most packages don't (by their design) acknowledge that this is a real problem. With much heavy breathing, they tell you 1000 tasks, 1600 with EMS, or some such. Gawd. You're out of runway by the time you link the fourth project.

"This kind of reporting is much more important than resource leveling, because many departments work on a 'do or die' type of schedule. Don't tell me you don't have enough bodies to get the job done! Get it done anyway!"

I realize that I've been troubled by the same questions, but I've never been able to identify the cause for my unease. In the future, I'll keep the "Roth Rules for Evaluating Project-Management Software" firmly planted in the back of my brain.

Hugh concludes by urging me to continue reporting on project-management packages. "They are a good way to keep your salary in others' hands. Some of them offer the opportunity to use a computer and make the job harder (as you pointed out). You get to use nifty things like 6-pen plotters. You get to spend several weeks figuring out the yes/no answer to the following preferencescreen question: 'Show negative float on Gantt?' And, not to forget, you get to appreciate really simple, elegant, intuitive packages like Q&A and SuperCalc 4."

Amen.

Ezra Shapiro is a consulting editor for BYTE. You can contact him on BIX as "ezra." Because of the volume of mail he receives, Ezra, regretfully, cannot respond to each inquiry.

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH

THE CORPORATE SOURCE

#### **COMPUTERS**

#### **HARDWARE**

**SOFTWARE** 

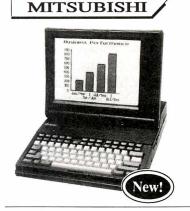
**PRINTERS** 

2500 WEST COUNTY ROAD 42 • #5 • BURNSVILLE, MN 55337 • (612) 894-0595

#### A Small Case For BIG Performance!!!

#### **TOSHIBA** CALL T1000 T1200F T1200H T3100 T3200 T5100 CALL





#### MP286L/20

- 11" Diagonal Black & White Display
- 20 MB Hard Disk
- 12 MHz 80286
- 1.4 MB Floppy Drive

#### Introductory Price

\$2695.00

Dual Floppy (1.4 MB) Model \$2195.00

**FAX Number: 894-6175** 

#### From MegaHertz

#### Easy Talk 3270

3270 Emulation Card for Toshiba Laptops; Fully supports IRMA & IBM Emulation. Auto-Config. - No Jumper Changes required. Includes software for 3270 and IND/FILE Transfer Support

\$599.00

#### Easy EGA

EGA Card for Toshiba T1200 and T3100 Laptops. Supports MDA, HGC, CGA & EGA

\$299.00

Easy Talk E2400

2400 Baud Modem for the Epson Equity LT

\$239.00

#### Weltec . . External 5.25" FDD

Specify TOSHIBA, ZENITH or NEC\*

\*No cable w/NEC Drive - Cable included in NEC Laptop Box

#### MHz INTERNAL MODEMS

1200 Baud \$139 2400 Baud \$239

Specify:

Toshiba, NEC EL/HD, Zenith 181/183 or SupersPort

#### WonUnder

\$299 Single card expansion slot for the T1100+, T1200, T3100/20 & T5100

Diconix 150P Portable Printer Laplink Plus

When Purchased with any Laptop

Prices Subject to Change

Without Notice

Competitive Price

Corporate Volume Discounts

 Net Terms to Qualified **Corporate Accounts** 

To Order Call:

(800) 255-4012

IN MN: (612) 894-0595

# Make your programs millions of times smarter.

More and more, programmers and workstation builders are using DESQview 2.0 as a development tool. The reason is simple. They can create powerful, multitasking solutions today for the millions of DOS PCs in use today. Solutions comparable to those promised for tomorrow by OS/2.

The API Advantage

Programmers who take advantage of DESQview's API (Application Program Interface) get access to the powerful capabilities built into DESQview—multitasking, windowing, intertask comunications, mailboxes, shared programs, memory management, mousing, data transfer, menubuilding and context sensitive help.

#### **Bells and Whistles**

A program taking advantage of the DESQview 2.0 API can spawn subtasks for performing background operations or new processes for loading and running other programs concurrently. It can schedule processing after an interval or at a certain time. It can use DESQview's intertask communications to rapidly exchange data between programs, share common code and data; or interrupt at critical events. It can use DESQview's menuing and mousing capabilities to create menus. And there's lots more it can do.

Some of the applications under development right now using DESQview 2.0 API Tools: CAD, Medical systems, insurance, 3270 mainframe communications, network management, real estate, typesetting, point of sale, education, commodity trading, stock trading and online voting.

#### 80386 Power

80386 programmers can take advantage of the 80386's protected mode for large programs, yet run on DOS and multitask in DESQview—side by side with other 80386 and DOS programs. The breakthroughs that make this possible: DOS Extenders from PharLap Software and AI Architects and DESQview support of these DOS extenders.

#### **DESQview Developer Conference**

So if you are a developer, looking to create programs with mainframe capabilities, but wanting to sell into the existing base of millions of DOS PCs, come to Quarterdeck's first DESQview API Developers Conference, August 16-18, 1988 at the Marina Beach Hotel, in Marina del Rey, California. For more information call or write us.

Come learn about the DESQview 2.0 API and 80386 DOS Extenders. Meet 80386 experts as well as those smart people who are creating DESQview 2.0 API workstations solutions.

And if you want to get a leg up before the conference, ask us about the DESQview API Tools for assembler or C programmers.

## Bringing New Power to DOS. DESQview 2.0 API Toolkit.



Quarterdeck Office Systems 150 Pico Blvd., Santa Monica, CA 90405 (213) 392 9851



## BE SECURE, NOT SORRY

Nobody likes to worry about security, but people problems and accidents happen

our hard disk doesn't boot. Or maybe it does boot, but only one file is left, and it seems to be named GOTCHA. Or maybe one of your employees quits suddenly and his or her new employer seems to know who all your customers are. Usually, it takes something like this to get the managers interested in computer security.

Security is not the most glamorous area in computing. Managers don't like it because security systems cost money. Employees don't like it because they think it's too inconvenient. The technical staff doesn't like it because they think it gets between them and the machine.

They're all right, of course. But they're also all wrong. Many things affect security, and not all of them apply to all computer systems. For starters, let's look at why security is important, and why it's worth spending money on.

#### Time Is Money

While your computers are certainly worth something in themselves, their real value isn't in the hardware. Instead, it's in the information the machine contains and the machine's importance to your operations. If the information had to be located and reentered, how much would that cost you? If the computer is necessary to some facet of your operation, how much would you lose if it were missing and you couldn't do the work without it?

The problem boils down to two areas: the safety of the computer itself and the safety of the information it contains. Because physical security and data security



are so different, the solutions to the problems usually seem different also. But, in reality, they are closely related. After all, if someone steals your computer, he or she probably has your data, too.

#### **Physical Security**

If you keep people away from your computer, they won't have the chance to steal it or fiddle with the stuff on the hard disk. If you keep it in a safe place, you won't have to worry about anything else happening to it, either. That's the basis of physical security.

Of course, you can't always keep the computer in the safest possible place. The users might not be able to work on it there, for one thing. But you can still keep people from taking the machine or tampering with it. The easiest way is to lock it. The IBM PC AT and most of its clones, as well as the IBM PS/2s, have a built-in lock that is reasonably effective against casual tampering. It secures the case and tells the computer to ignore the

keyboard. While a determined person can pry open the case to override this feature, most people won't do that.

Not all computers have a keylock, though. If you can't keep your equipment in a locked room when it's not in use, you can at least lock it inside a cabinet. Again, this provides some security against casual tampering, but some of these cabinets are unwieldy and others provide a convenient way to roll an entire system out the door. If theft is your biggest worry, there are always systems like Anchor Pad that let you lock the computer system to a flat surface such as a tabletop. Then thieves have to steal the table along with the computer—a much more conspicuous act.

#### **Data Security**

If your business is like most other businesses, the biggest investment you have in your computer system is the data that's inside it. If that data disappears, you

continued

could be out of business, or worse. In many cases, the data is worth a great deal more than the computer it resides in.

Protecting that data means preventing people from removing, altering, or copying it, and protecting yourself from losing the use of it through system failure. In the first case, people are the threat to data security. Some people are really out to do you harm. Others are simply careless or not trained properly. And then there's the problem of losing data through ordinary accidents and system failures. In any case, you're out of business, whether you lost your data through the actions of a disgruntled employee or because the head crashed on the hard disk.

#### **Protecting against Loss**

Data loss is the easiest problem to protect against. All you need to do is keep a current backup. Then, all it takes is a few minutes to restore your data, and you're back in business. How you back up your data, whether with a software product such as Fifth Generation System's Fastback Plus or a tape drive, makes little difference. What's important is that you do it.

#### The People Problem

Once you've taken care of protecting yourself against losing the data, then you have to worry about the people. Most instances of data loss that I have come across were the result of accidents. You can reduce the problem of unintentional data loss through training. Once people understand that formatting the hard disk makes it hard to use the data that was on it, they usually won't do it.

However, then there are the people who really want to erase everything or want your information for themselves. This is what most people think of when they think of computer security. This is also the focus of most security products and the area in which password access, encrypted data, and the like become important.

Depending on your type of business, malice may not be a significant threat. Most businesses, however, keep some sensitive information in their computers. It could be related to a firm's bidding process or personnel records, or it could be other data that will give your competition the edge. How do you keep this information secure?

First of all, keep the computer itself in a locked office. It's amazing what people will do out of curiosity, given enough time. Second, lock the computer, if you have one that will lock. Finally, consider some sort of security system.

#### Items Discussed

#### **Security Systems**

There are hardware and software systems that will prevent unauthorized people from using the computer and permit others to perform only certain actions. These programs require users to identify themselves, and they require a password to use the computer.

I've already mentioned machines like the IBM PS/2s, which have a lock on the case. You can also set up the PS/2s so that you must enter a password before you can use the computer.

More thorough systems control nearly every aspect of the computer operation. Normally, they do this through a series of menus that control access to the operating system, restricting most users to a few selected operations. These systems do, however, restrict the flexibility of use. You need to decide if the individual case justifies this loss of flexibility.

A couple of the better-known security systems are Watchdog from Fisher International Systems and Access II from Kinetic Software Corp. Both companies base their security systems on multiple access levels through menus and user passwords. Kinetic includes a board that fits IBM PC-compatible computers and forces the machine to boot only off the hard disk.

#### Learning about Security

Before you get too deep into setting up security systems, it's probably a good idea to learn a lot about them. One interesting source of help is the National Computer Security Center. This organization operates under the auspices of the super-secret National Security Agency, but it exists to help all computer users learn more about security and to help the computer community cope with security issues.

The Center publishes a number of pamphlets, posters, and books that it will send you. You can pick up some of these materials free at computer shows or purchase them for a nominal fee. You can contact the Center at 9800 Savage Rd., Fort Meade, MD 20755, (301) 688-8744. The Center, along with the National Bureau of Standards, hosts the National Computer Security Conference each year. The conference is open to anyone and has tracks for people of all levels. This year it's in Baltimore, starting October 17 and running through October 20. The price for the conference is \$150 before October 7 and \$175 thereafter.

Does all this sound like a lot of trouble? Well, maybe. Many systems probably don't need a lot of security because they don't do much. But think about your other computers. What would happen to your business if the information in them disappeared or got to your competitors tomorrow?

#### OS/2 Update

A businessman asked me about OS/2 the other day. He wanted to know if he should put off buying his software until an OS/2 version came out. I advised him not to wait.

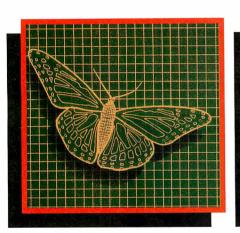
As you may remember from my August column, my investigations at COM-DEX showed me that there was virtually no software available for use with OS/2, and much of what was could also be found for MS-DOS. Since then, I've gone to PC Expo. The picture hasn't gotten much better. The advice remains the same. If you need software, and there's a DOS version available now, don't wait.

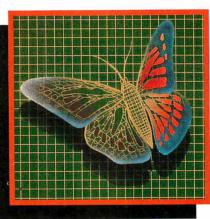
Coming up in future issues—to LAN or not to LAN? Also, does productivity software really help productivity? ■

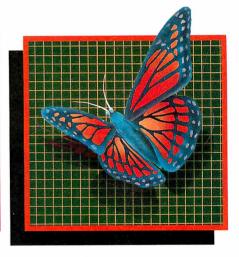
Wayne Rash Jr. is a member of the professional staff of American Management Systems, Inc. (Arlington, VA), where he consults with the federal government on microcomputers. You can reach him on BIX as "waynerash."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

## 299 For 3-D C u can't be oendi thousands more.







You can spend thousands of dollars for three dimensional CAD software and still not get the power and capability that DesignCAD 3-D

offers for a remarkable \$299! DesignCAD 3-D is proof positive that you don't have to spend a fortune for quality.

DesignCAD 3-D allows you to develop and advance any design in 3 dimensional space, while providing you with features such as shading, hidden line removal, printer and plotter support. DesignCAD 3-D's extensive file transfer utilities allow you to: transfer documents to and from IGES, DXF HPGL, transfer to GEM and Post Script and to read ASCII text files and X, Y, Z coordinate files. It allows up to 4 simultaneous views (any angle or perspective) on the screen. Complex extrusions, extensive 3-D text capabilities, auto

dimensioning and a host of other features are all included with DesignCAD 3-D, all at no extra charge.

The compatibility that DesignCAD 3-D offers you means that it can be used with almost any PC compatible system. It supports

> more than 200 dot matrix printers, more than 80 plotters and most digitizers and graphic adapters. DesignCAD 3-D can read drawings from most other CAD systems.

> The best reason to buy DesignCAD 3-D is not the low price, the performance or the compatibility. The best reason is the amazing ease of use. DesignCAD 3-D's powerful commands mean that you can produce professional 3-D drawings in less time than you thought possible. In fact, we think you'll agree that DesignCAD 3-D is easier to learn and easier to use than any 3-D CAD system for IBM PC, at any price!

See your local computer dealer for DesignCAD 3-D, or contact:

To quote from P.C. MAGAZINE'S June 14, 1988 issue: "DesignCAD 3-D... delivers more bang per buck than any of its low-cost competitors and threatens programs costing ten times as much."



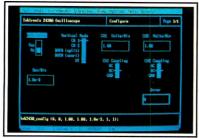
327 S. Mill St., Pryor, OK 74361 (918) 825-4844 FAX 918-825-6359 Telex 9102400302

### We've Invented the Future of Instrumentation Software . . . Twice.

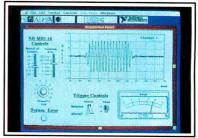
#### With Words With Pictures

#### **Acquisition**

Integrated libraries for GPIB, RS-232, A/D-D/A-DIO plug-in cards, and modular instruments.



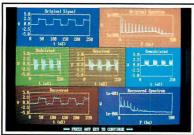
Intuitive character-based function panels that automatically generate source code.



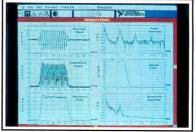
Front panel user interface with virtual instrument block diagram programming.

#### **Analysis**

Extensive libraries for data reduction, digital signal processing, and statistical analysis.



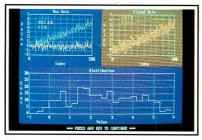
Over 100 analysis functions plus all the built-in functions of your language.



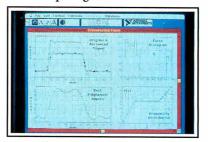
Over 250 icons for computation and

#### **Presentation**

Flexible high-performance graphics and report generation.



Extensive graphics support for CGA, EGA, MCGA, VGA, and Hercules.



Macintosh Desktop Publishing compatibility.

The Software is the Instrument

#### LabWindows™-

for the DOS-based PC and PS/2, with Microsoft QuickBASIC or C.



12109 Technology Boulevard Austin, Texas 78727-6204 800/531-4742 512/250-9119

LabVIEW®for the Apple Macintosh

Circle 181 on Reader Service Card for LabWindows. 182 for LabVIEW.



# MS-DOS, MINIFANS, MATH, AND MICE

Hardware, software, and peripherals make the Mac a multifaceted machine

ack in November 1987, I was looking for some way to reduce the number of computers that inhabit my office and my home. If I could semi-retire a couple of them, I could reclaim some valuable table space. It was about that time that I remembered the AST Mac286 coprocessor board I had seen at the Boston MacWorld in August 1987. In demos held for the press, this board (which is really two boards cabled together that occupy two NuBus slots in a Mac II) seemed to do the job of an 8-MHz IBM PC AT.

Well, I thought, here's a chance to retire a couple of old ATs and still keep basic AT/MS-DOS functionality. So I bought a couple of these beasts, along with a couple of Apple's 5¼-inch PC-compatible floppy disk drives. Installation was fairly painless.

In less than an hour per Mac II, I had a dual-operating-system computer that ran both the Mac operating system and MS-DOS. The Mac286 even shared my existing Mac hard disks by setting up separate DOS partitions on them. Goodbye, ATs. Hello, table space!

Alas, my compact-computing joy was short-lived. I issued a DIR command in the Mac286 window, and something weird happened. The video scrolling became slow and jerky—practically unreadable. And that happened with the standard monochrome-emulation mode in the Mac286 window, on an Apple color monitor.

Okay, I can fix that, I thought; I'll try the Hercules-emulation mode. Same problem. Must be the monochrome emulation on a color monitor, I thought. So I tried the CGA emulation. That was even worse. I tried running Microsoft Windows 2.03 under the Hercules emulation. It was so slow, I gave up. In fact, after less than a week, I gave up on the Mac286 altogether. I couldn't get any DOS work done with them because of the severe video problems.

Out came the old ATs. Goodbye, table space.

AST acknowledged the video problems with the driver software and promised fixes. In early June, I received its first update, version 1.01.

What a difference a version number makes! The video performance of the Mac286 is dramatically improved with the 1.01 software. It's so much improved that I can now use my Mac IIs for all my DOS work.

Besides improving the display speed, AST polished and cleaned up other parts of the interface. MultiFinder support, which was not quite there in version 1.0, has been upgraded. You can now copy DOS screens to the Mac Clipboard by columns as well as by lines. This makes it a snap to transfer stuff from a DOS database, spreadsheet, or statistics file to a Mac application.

AST will send you the 1.01 software upgrade for free if you are a registered Mac286 owner. If you buy the Mac286 coprocessor boards now, you'll get the 1.01 software. In either case, the software update turns a clever but virtually useless Mac II hardware accessory into a useful, workable solution to running DOS on a Mac.

#### **Skeletons in 4th Dimension**

Even though the promised update to 4th Dimension (dubbed version 1.1) has been delayed, Acius has not been sitting back twiddling its corporate thumbs waiting for Laurent Ribardiere to finish it. Over the last several months, Acius has released two inexpensive, but impressive, applications written in 4D: MiniFans and TopGuys.

MiniFans is a compact version of the internal corporate correspondence, customer-tracking, and distributed-information productivity system that Acius uses every day. TopGuys is a special database that contains information on about 400 influential Macintosh specialists, such as journalists, vendors, developers, and so on. In short, it's Acius president Guy Kawasaki's personal Rolodex of MacFolk. It's a very useful tool, as well as fun to rummage through.

MiniFans and (in particular) TopGuys are excellent examples of well-behaved and well-designed 4D applications. Acius wants developers and users to see how the internals work with both; that's part of the reason they have distributed them. Kudos to Acius for a nice job.

Another Acius 4D application that should be coming out soon is called Skeleton, written by technical-support wizard Dave del'Aquila (the same guy who wrote MiniFans). I got a chance to put it through its paces when I visited the Acius headquarters in Cupertino in June.

Skeleton is a good name for this developer's tool, since it provides the framework of a typical 4D application and provides the lowest common denominator of functions that these applications require. It is also fully customizable and extensible. This "skeleton" allows a design to be undertaken in the 4D custom environment, which helps speed application prototyping. Skeleton should be a help to both experienced 4D developers and novices who need some firmer ground to stand on while learning 4D.

#### Mathematica on the Mac

I've been using the 1.0 release of Mathematica for the Mac II for several weeks now. Even though this release is not bugfree and the documentation is not complete (two problems that Mathematica's publisher, Wolfram Research, expects to fix before this column hits the newsstands), Mathematica is certainly an im-

. continued pressive piece of software.

Mathematica is a general software system for doing math computations. The application will eventually run on a number of computers, including large systems and shared workstations (e.g., Sun, NeXT, and IBM), but its Mac implementation is the first and perhaps the most interesting, because it works fully with the Mac's user interface.

Mathematica works like a real-time electronic whiteboard (formerly black-boards—how times change) that can solve equations. You can type in your equations using numeric forms, but you can also use more advanced symbolic forms. Mathematica's symbolic processing accounts for a good measure of its power.

You can enter simple numerical calculations in Mathematica as you would with an electronic calculator, using Mathematica's syntax. For example,  $In[1] := N[log [4\pi]]$  finds the value of  $log (4\pi)$ . But you can also enter symbolic calculations directly, which is something no calculator permits. For example, the entry  $In[3] := x^4/(x^{2-1})$  finds the formula for the integral

$$\int x^4/(x^2-1)\ dx.$$

Further, you can have Mathematica integrate this expression with the command In[4] := Integrate [%, x]. Mathematica then finds the explicit formula for the integral:

Out[4] = 
$$x + \frac{x^3}{3} + \frac{\text{Log}[-1 + x]}{2}$$
  
-\frac{\text{Log}[1 + x]}{2}.

Symbolic algebra and calculus could not be done previously on computers of the Mac II's size; programs of this sort were typically found only on minicomputers or supercomputers. Overall, Mathematica does many different kinds of algebraic computations, including expansion, factoring, and polynomial and rational expression simplification. Algebraic results for some kinds of matrix operations are also possible. In addition, as my example above shows, Mathematica can do calculus, evaluating derivatives and integrals and deriving power series approximations.

Mathematica on the Mac II with an RGB monitor provides a dynamite full-color display that's especially impressive when results are graphed in two and three dimensions. The jazzy display is backed by a function library of more than 400 math functions.

#### Items Discussed

4th Dimension 1.06	\$695
MiniFans 1.0	\$20
Skeleton .999	\$20
TopGuys 1.0	\$20
4D run-time module	\$75
(MiniFans and TopGuys requ	uire
4D run-time module)	
Acius, Inc.	
20300 Stevens Creek Blvd.	
Suite 495	
Cupertino, CA 95014	
(408) 252-4444	
Inquiry 801.	

Mathematica 1.02 Enhanced
Macintosh II Edition ...... \$795
Mac Plus/Mac SE version ..\$495
Wolfram Research, Inc.
P.O. Box 6059
Champaign, IL 61821
(217) 398-0700
Inquiry 802.

Mathematica is something of a breakthrough product: It will give educators an entirely new and powerful tool in teaching mathematics. Confirmed mathphobic students may very well be drawn into Mathematica's impressive displays and its ability to solve equations quickly and display graphical results; this could enable them to absorb the algebra and calculus that seemed impossible to comprehend from a textbook.

#### Of Mice and Music

As good as Mathematica is, there is more to life than plotting functions or deriving a Taylor series. The publisher of Music Mouse, Opcode Systems, knows this. Music Mouse takes an approach to making music that is similar to Mathemati-

ca's approach to manipulating mathematics: Neither requires you to be an expert in the field to make good use of it.

Music Mouse is a control application that lets your Macintosh make music all by itself, or with the aid of an external speaker or stereo system, or through an external MIDI (musical instrument digital interface) synthesizer. Music Mouse also works as a stand-alone controller for MIDI synthesizers that do not have a keyboard.

It's difficult for me to explain how Music Mouse works since it's such a visceral experience. But here goes, anyway.

Once you start the application, you can control the music you're creating by moving the mouse and pressing keys on the keyboard. The Mac screen gives you an x,y grid display with two different melodic lines that are "wired" to the x-axis and y-axis movements of the mouse. The application sticks in two additional melodic lines, so you have four voices all told.

These two application-supplied lines track the ones you are creating with the mouse, and they can be varied with keyboard control (as can pitch, tempo, and so forth). The screen display gives you some visual feedback for the music created, using what Opcode calls a polyphonic cursor to show the "motion" of the music, as well as the pitch. While the effect and action are hard to describe, the results are stunning, even without hooking up a MIDI synthesizer.

The one big omission with Music Mouse is recording: As yet, it doesn't have a direct recording mode. However, you could use a macro recorder like Tempo II, AutoMac III, or the Macro-Maker CDEV (supplied with System 6.0) to record a Music Mouse session. Just make sure that you use the real-time recording modes for these utilities; otherwise, your music will sound strange, indeed.

The Music Mouse can be used by firsttime and professional musicians. If you're a novice, it's fun to explore some basics of music composition using this application. One caveat: It won't run properly under MultiFinder.

Don Crabb is the director of laboratories and a senior lecturer for the University of Chicago department of computer science. He is also a consulting editor for BYTE. He can be reached on BIX as "decrabb."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458



Affordable line art and halftones without sacrificing your printer.

VisionScan™ delivers quality scans in seconds without tying up your ImageWriter™ printer.

Whether you're scanning photos, graphs, charts, or other original materials for newsletters, marketing, reports, layouts or other applications, VisionScan™ produces affordable halftone images and extremely high quality line art.

Scan 3-D...and at no extra cost.

VisionScan can expand your view to 3-D. The roomy overhead scanner accepts objects up to one inch in height and gives you an added vantage point — a value many higher priced scanners can't begin to offer.

FREE DeskPaint" Software.

The DeskPaint™ Software desk accessory inspires full graphic editing without deserting your desktop publishing program. It crops, sizes, details, lightens, darkens and embellishes plain art into professional presentations.

Scan and edit text like the pro's with an optional O.C.R. software program, only \$199.

With the revolutionary Read-it!™ software program by Olduvai Corporation, VisionScan enables your Macintosh™ to read whole pages of

text, then store and manipulate them faster than ever before.

Why buy from Mirror?

- Buying direct saves money Full 30 day "money back" guarantee
- Full 90-day warranty An on-going commitment to innovation

To order VisionScan™ and your free DeskPaint™ software package, call toll free: 1-800-654-5294



Mirror Technologies, Inc. 2644 Patton Road Roseville, MN 55113





ageWriter are trademarks of A demark of Zedcor Incorporate nark of OLDUVAI Corporation

Prices subject to change without notice.

## UserSoft/C Means Business

\*\* Sample INPUT & OUTPUT of Business C, S/AM, SUPERIOR and SCREEN \*\*

programmed by Mr. Smith's maiden name is Anderson

do are you ?Well.... I am Peter

\*\*\* [N] \*\*\*

Please enter the filename for Sales History : c:SALES

enter range of names (FROM ... TO ...) : let's start FROM Gibbens TO Maple

>> password for file(c:SALES) is \*\*\*\*\*\*\*\*\*\*\*

		MANUAL.	A 1	PK 20	100
		9 4 1		2.25	Acres 64
Marie Co.	X 10.		38	4	ľ
	1.44		V. 1		10000

575-83-4990 Gibbens	- sport	\$44,637.00DR
486-00-1533 Hagen	- cosme	\$23,20CR
692-54-7311 Hamilton	– retai	\$191.95CR
575-72-1638 Jackson	– retai	\$3,144.06DR
394-50-1123 Lampman	– sport	\$98.63DR
105-33-6296 MacDonald	- cosme	\$2.45CR

#### Novem/15 1988 - TUE

```
include "Usersoft.h"

Include "Isersoft.h"

Include "Isersoft.h"
```

#### UserSoft/C is the **Business C**

UserSoft Business C is the financial C compiler that makes sense to both clients and programmers. It is not just another C compiler.

#### Compare the functions:

UserSoft Business C is a superset of Power C. Microsoft C and Turbo C. It has over 1,000 standard and business development functions. The SuperIOR component of UserSoft Business C has the input/output features of COBOL, PL/1, FORTRAN and BASIC and yet can read financially formatted data (eg. \$2,109.87 CR). UserSoft Business C has 36 easy-to-use matrix functions for management science (operational research), business statistics, finite element and circuit analysis.

#### Compare the Portablity:

UserSoft Business C supports the latest features of standard ANSI C. If you already have a C compiler (MS-DOS, UNIX, VS, VMS, MVS, etc.) our Business Development Tool package will commercialize your compiler for only \$199.95 for PCs. This package is suitable for IBM, Wana, Sun, VAX and other systems.

#### Compare the Documentation:

The UserSoft Business C manual provides actual programming examples for every function. over 1,000 of them.

#### Compare the Product:

UserSoft Business C is the capability union of C + COBOL + BASIC + PL/1 + FORTRAN + Make + SCREEN:PC version of UNIX's curses + database tools + graphic tools + IBM mainframe's VSAM + a multiple window graphic debugger and

#### Compare the Price:

It's a fraction of what you might expect — the complete UserSoft Business C package is available at the introductory price of \$249.95 while the Business Development Tool Package is available for \$199.95.

"In our testing, none of your claims have failed. It is to our advantage to use SUPERIOR, SAM and SCREEN for our research. I strongly recommend that all professional program developers use SUPERIOR, SAM and SCREEN for artificial intelligence, scientific, engineering, industrial, financial and especially business related applications."

Dr Paul R Schroeder, PhD (MIT) President of Maximum Storage, Inc. Co-Founder of INMOS US Sole Designer of Mostek 4116 Co-Designer of Mostek 4027

#### UserSoft Business C: The ultimate C language for **business & financial** applications

UserSoft Business C is a new ANSI compatible compiler that runs faster and easier than Microsoft C and has more functions than Turbo C®. It cuts coding for business and financial applications by at least 50% - 90%.

#### If You're Just Beginning, Usersoft Business C makes

learning C a pleasure.

#### If You're Programming In COBOL, BASIC or FORTRAN,

switching to UserSoft Business C will be easier than you expect. UserSoft Business C retains the best of these languages while simplifying C without loss of any standard C features.

#### If You're Programming in C,

you may switch to UserSoft Business C or enhance your current compiler with our Business Development Tool package. This will give you UserSoft Business C capabilities on most popular systems such as Microsoft C, Power C, Turbo C, UNIX C, and Wang VS C.

#### **UserSoft Business C:** With a new state-ofthe art C debugger

UserSoft Business C debugger will reduce the time you spend debugging your C programs by at least a factor of 10. It allows you to debug graphics programs on a single monitor.

#### **UserSoft Business C:** The World's most versatile Data Manager and **Database Tool**

Our Structured/Access Method (S/AM) allows:

- · unlimited types of key (including graphics)
  • unlimited numbers of key parts
- · unlimited numbers of data fields
- · mixing of fixed and variable lengths for data fields or key parts
  • data encryption from file level down to
- byte level
- · unlimited devices for storing a key part or a data field
- · unlimited size for any key part
- · unlimited number of tables
- · unlimited concurrently open files
- maximum protection on data security

S/AM is well suited for applications to finance, banking, business, imaging, artificial intelligence, knowledge-based information, science, engineeering, simultation and industrial control.

#### **Business Development Tool**





#### USERSOFT

If within 60 days of purchase, this product does not perform in accordance with our claims, call our customer service department and we will arrange a refund.

All UserSoft products are trademarks or registered trademarks of UserSoft Systems Limited. Other brand and product names are trademarks or registered trademarks of their respective holders. Copyright® 1988 UserSoft Systems

#### **UserSoft Systems Limited** Suite 1512, 409 Granville St Vancouver, BC, Canada V6C 1T2 Telephone 604/681.8872

Power C is a trademark of Mix Software MS-DOS, Microsoft C is a registered trademark of Microsoft Corporation Turbo C is a registered trademark of Microsoft Corporation Turbo C is a registered trademarks of Borland International Business Machine Sun is to trademark of Sun Microsystems DEC, VMS and VAX are trademarks of Digital Equipment Corporation UNIX is a trademark of Sun Microsystems DEC, VMS and VAX are trademarks of Digital Equipment Corporation UNIX is a trademark of Bell Laboratory VS is a trademark of WANG Laboratory

To order Call: 1-800/663-0322 60 Day Money Back Guarantee **Not Copy Protected** 

See us at Comdex 88 at the Tropicana Booth — T617

The future of personal computing is clear. More powerful PCs. Easier to use PCs. With graphics and character-based programs working side by side. Talking to each other. Multitasking. Windowing. Menuing. Mousing. Getting your work done easier and faster.

#### Have it all now.

DESQview™ is the operating environment that gives DOS the capabilities of OS/2. $^{\text{TM}}$  And it lets you, with your trusty 8088, 8086, 80286, or 80386 PC, leap to the productivity of the next generation. For not much money. And without throwing out your favorite software.

Add DESQview to your PC and it quickly finds your programs and lists them on menus. So you can just point to the program, using keyboard or mouse, to start it up. DESQview knows where that program lives. And what command loads it.

For those who have trouble remembering

DOS commands, it adds menus to DOS. It even lets you sort your files and mark specific files to be copied, backed-up, or deletedall without having to leave the program you're in.

Best of all, DESQview accomplishes all this with a substantial speed advantage over any .alternative environment.

#### Multitask beyond 640K.

When you want to use several programs together, you don't have to leave your current program. Just open the next program. View your programs in windows or

Switch Window Close Window Rearrange R Scissors Help for DESQview Quit DESQview

> full screen. Open more programs than you have memory for. And multitask them. In

For programmers, DESQview's

API, with its strengths in inter-

task communications and multi-

tasking, brings a quick and easy

way to adapt to the future. With

the API's mailboxes and shared

able to design programs running

programs, programmers are

on DOS with capabilities like

those of OS/2.

640K. Or if you own a special EMS 4.0 or EEMS memory board, or a 386 PC, DESQview lets you break through the DOS 640K barrier for multitasking. If you have other non-EMS memory expansion products like AST's Advantage or the IBM® Memory Expansion Option, we have a

solution for you, too. The ALL CHARGE-CARD™ 'unifies' all your memory to provide up to 16 megabytes of continuous workspace. DESQview lets you use this memory to enhance your productivity. You can start 1-2-3 calculating and tell Paradox to print mailing

labels while you're writing a report in Word Perfect, or laying out a newsletter in Ventura Publisher, or designing a building in AutoCAD.

DESQview even lets you transfer text, numbers, and fields of information between programs.

Fulfill the 386 promise.

For 80836 PC users, DESQview becomes a 386 control program when used in conjunction with Quarterdeck's Expanded Memory Manager (QEMM)-386—giving faster multitasking as well as virtual windowing support.

And when you use DESQview on an IBM PS/2™ Model 50 or 60 with QEMM-50/60 and the IBM Memory Expansion Option, DESOview gives you multitasking beyond 640K.

#### **Experts are voting for** DESOview. And over a million users, too.

If all of this sounds like promises you've been hearing for future systems, then you can understand why over a million users have

chosen DESQview. And why PC Magazine gave DESQview its Editor's Choice Award for "The MAGAZINE Best Alternative to OS/2," why readers of InfoWorld twice voted
CHOICE
NOV. 24, 1987

Product of the Year"

why, by popular vote at WORLD 1986 Comdex Fall for two years in a row, DESQview PRODUCT OF THE was voted "Best PC Environ-Y E A R ment" in PC Tech Journal's Systems Builder Contest.

DESQview lets you have it all now.

180 Sarah 181 Walter Qview-LINK-Mechanica (Met Earn. of Affiliates) ral & Administration

DESQVIEW SYSTEM REQUIREMENTS: IBM Personal Computer and 100% compatibles (with 80%, 8088, 80286, or 80386 processors) with monochrome or color display; IBM Personal System/2 • Memory: 640K recommended; for DESQview itself 0-145K • Expanded Memory (Optional): expanded memory boards compatible with the Intel AboveBoard; enhanced expanded memory boards compatible with the AST RAMpage; EMS 4.0 expanded memory boards\* Disk: two diskette drives or one diskette drive and a hard disk\* Graphics Card (Optional): Hercules, IBM Color/Graphics (CGA). IBM Enhanced Graphics (EGA), IBM Personal System/2 Advanced Graphics (VGA)• Mouse (Optional): Mouse Systems, Microsoft and compatibles Modem for Auto-Dialer (Optional): Hayes or compatible Operating System: PC-DOS 2.0-3.3; MS-DOS 2.0-3.2 • Software: Most PC-DOS and MS-DOS application programs; programs specific to Microsoft Windows 1.03-2.03, GEM 1.1-3.0, IBM TopView 1.1 • Media: DESQview 2.0 is available on either 5-1/4" or 3-1/2" floppy diskette.

VECI	Qty Product	Format Price	e Each Totals	
YES!	DESQview 2.0	□5-1/4 □3-1/2 \$1	129.95	
I need increased	QEMM-386	□5-1/4 □3-1/2	\$59.95	
	QEMM-50/60	□5-1/4 □3-1/2	\$59.95	
productivity now!	ALL CHARGECA	ARD (Special for DESQview owners) \$2	200.00*	
Name	9	Shipping & Handling \$5 in USA/\$10 outs	side USA	
		Calif Residents add 6.5%		
Address	Cu to 7'	_	nd Total	
City State Zip Payment Method Usia MasterCard Expiration / 150 Pico Boulevard, Santa Monica, CA				
Payment Method 🗆 Visa 🗀 MasterCard Expiration/				
Account #		(213) 392-9	9851	

\*This ALL CHARGECARD is designed for the IBM PC AT and PS/250 and 60. If you have another type of 80286-based PC, there's a version for you, too. Please call 1-(800) 387-2744 for special ordering information. Offer expires August 31, 1988. Trademarks are property of their respective holders: IBM, OS/2, PS/2, 1-2-3, Paradóx, Word Perfect, Véntura Publisher, AutoCAD, Intel, Above Board, AST, RAMpage, Advantage, Hercules, Mouse Systems, Hayes, Microsoft, Windows, TopView.



## THE GOOD NEWS AND THE BAD NEWS

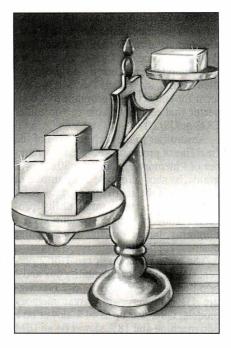
When it comes to performance, there's a price to pay for all those nifty OS/2 features

S/2 is more important to an OS/2 application than DOS is to a DOS application. Given that, how does OS/2 perform relative to DOS? Rarely better, often only a wee bit worse, and sometimes a lot worse. As a multitasking platform, it performs better than expected.

How do I know? Simple—I ran some benchmarks. Benchmarks are one of life's sordid pleasures. Artists often say, "Everyone's a critic." Hardware and software designers could say, "Everyone's a benchmarker." Another reason to do benchmarks is the interesting mail you get after writing articles.

OS/2 is more important to an OS/2 application than DOS is to a DOS application because, as I said last month, OS/2 is a true operating system and DOS is not. If a DOS application needs to write to the screen, it can allow DOS services to do it, or it can write directly to the video buffer itself. Allowing DOS to put the characters on the screen ensures compatibility across machines and versions of DOS, but it sacrifices speed. A DOS application requiring snappy screens can always opt to bypass DOS. Under OS/2, an application's I/O must go through the operating system-hence the interest in OS/2's performance.

An associate and I have benchmarked OS/2 services, using a combination of simple programs and more complex systems to answer a number of questions. The questions and answers, summarized, follow. (Note: Whenever I say "OS/2," I mean "protected-mode OS/2," unless I specifically mention OS/2's DOS-compatibility box.)



Does a program run faster under DOS or under OS/2?

OS/2 is, in general, up to 20 percent slower than DOS, except for disk I/O. Unbuffered disk I/O is about 50 percent slower under OS/2.

Does a program run faster under DOS or under the OS/2 DOS-compatibility box?

The compatibility box runs programs up to 4 percent slower than DOS, except for disk I/O. Disk I/O can be 50 percent (or more) slower under the compatibility

Microsoft claims improved video I/O with OS/2. Are OS/2 video writes faster?

In some cases, yes: TYPE writes to the screen over twice as quickly under OS/2. In other cases, the result is a toss-up.

If you run multiple programs under OS/2, how great is the multitasking overhead?

Fairly low. It appears that you pay for multitasking up front, with the 10 to 20

percent system overhead. Extra per-task overhead is fairly small, no larger than 2 percent.

How does the compatibility box affect OS/2 multitasking overhead?

Radically. By design, the compatibility box does not run at all when in the background. When the compatibility box is running a DOS program in the foreground, the background OS/2 processes slow down by a factor of 100 to 500 times.

How does the choice of processor chip affect DOS versus OS/2 comparisons?

Surprisingly, the ratios of DOS times to OS/2 times do not vary much from the 80286 chip to the 80386 chip.

How much slower or faster does a program run in OS/2 background, compared to foreground?

That depends on the PRIORITY= parameter. With PRIORITY=ABSOLUTE, there is no difference for CPU-intensive tasks. Screen writes are actually slower in the foreground than in the background, because background screen writes are made to regular memory, while foreground screen writes are made to slower video memory.

With PRIORITY=DYNAMIC, the background process seems to wait for the foreground process to complete before it starts. (Yes, it's strange, and I'll explain further next month.)

Now let's look in detail at the benchmarks.

#### To the Bench

What would a benchmark suite be without the venerable Sieve of Eratosthenes? We ran the Sieve (a general compute-bound integer program), the Savage test (a floating-point test), and three tests designed to isolate video response and disk speed.

To ensure consistency, we used Mi-

IOtech has the widest selection of easy-to-use interfaces & software for **IEEE 488** (GPIB/HPIB) systems.

- Instrument & plotter controllers (internal & external) for PCs, PS/2s, & Macintosh
- Converters from IEEE to RS-232/422. digital I/O. modem, realtime clock, SCSI, & analog I/O
- IEEE bus extenders via RS-422 or fiber-optics
- 512K IEEE data buffers & expanders
- Software for IEEE control from languages & Lotus 1-2-3®
- Menu-driven graphics & analysis software
- 30 day money-back guarantee
- · 2 year warranty
- Call for your FREE Technical Guide



*IOtech...the choice is easy* 



(216) 439-4091 Telex 6502820864 Fax (216) 439-4093

25971 Cannon Road • Cleveland, Ohio 44146 London (0734) 86-12-87 • Paris (1) 34810178 • Zurich (01) 821 944 Milan 02-4120360 • Linkoping 013 11 01 40 • Amsterdam 01830-35333 Sidney (2) 452 3831 • Munich, and other European, North African, and Middle East countries not listed (089) 710020.

#### **Table 1:** Differences in the architectures of Intel's 80x86 microprocessors have led to the development of different memory models.

Memory model	Number of code segments	Number of data segments	
Tiny	One single segment sh	ared for code and data	
Small	1	1	
Medium	1	Multiple	
Compact	Multiple	1	
Large	Multiple	Multiple	
Huge	Multiple; data structure	Multiple; data structures can be > 64K bytes	

crosoft's dual-mode C and BASIC compilers to generate both real-mode (DOS) and protected-mode (OS/2) code from the same source. Whenever possible, we just compiled and linked one program, then bound it. ("Bind" is Microsoft's term for subjecting a program to a converter that renders it able to run under DOS or OS/2.)

Absurdities in the architectures of the Intel line of processors have led to a number of "memory models" for 80x86 programs, as shown in table 1. Examples of programs in the small and medium categories include many small utility programs and, of course, benchmarking programs, but few of the large popular business applications.

The Sieve benchmark ran 1 or 2 percent slower in the compatibility box and 4 or 5 percent slower under OS/2 (see figure 1). However, with larger memory models, OS/2 was up to 44% slower on a 386 machine and 18% slower on an IBM PC AT (due, no doubt, to their different memory architectures.)

Results of the Savage test (see figure 2) were consistent; the compatibility box slowed the programs by a few percent, and OS/2 slowed them by about ten percent on the 386 and 5 percent on the AT.

We tested video I/O with a simple test designed to TYPE a file to the screen 100 times-first under DOS, then under OS/2. The tests were done on a 16-MHz 80386 with a Compaq VGA board.

Under DOS, the task took 60.4 seconds, while OS/2 took 27.1 seconds. Impressive. But then we created a simple program that writes lines to the screen until it runs out of time (15 seconds). The results contradicted those of the first test. In this case, DOS was able to write 2171 lines, while OS/2 wrote only 1820 lines. We wrote the program in Microsoft BASIC and compiled it for both DOS and OS/2, using the BASIC 6.0 dual-mode compiler. Obviously, OS/2 screen handling can be faster than DOS, but not always, depending on how you do it.

#### Disk Access

Our preliminary tests showed that OS/2 was a bit slower at disk access than DOS. The Norton Utilities provided a simple test: We ran DISKTEST under DOS, and then in the compatibility box. With disk caching enabled, OS/2 operated nearly as fast as DOS without a cache enabled. Without the cache, OS/2's performance was miserable: 1369.8 seconds, compared to 90.3 seconds for DOS.

OS/2's performance (relative to DOS) suffers significantly in programs that do a lot of disk input and output and for programs that use more than 64K bytes of data. While the first category may not apply to many programs, recall that large memory access was one of the principal reasons for developing OS/2 in the first place. Good disk performance is, of course, important for many applications.

As a final DOS versus OS/2 comparison, we used C code from an August 1984 BYTE article, "Benchmarking UNIX Systems" by David F. Hinnant. The results are shown in table 2. One interesting number comes up: Notice that, despite the fact that all the C programs run faster under DOS than under OS/2, the Dhrystone runs faster under OS/2! Bear in mind that there is nothing in the Dhrystone that isn't in the other tests. Could there be a "benchmark detector" in the Microsoft C 5.1 compiler?

#### OS/2 Tip of the Month: Making DOS and OS/2 Coexist

If you use the Microsoft Developer's Toolkit, you know that Microsoft included a neat feature whereby your program will prompt you at boot time with

Boot: Enter for OS/2, ESC for DOS

By pressing the Escape key or the Enter key, you can boot either operating system. It's called the "dual boot" feature. For some unknown reason, IBM left it out of its OS/2.

continued

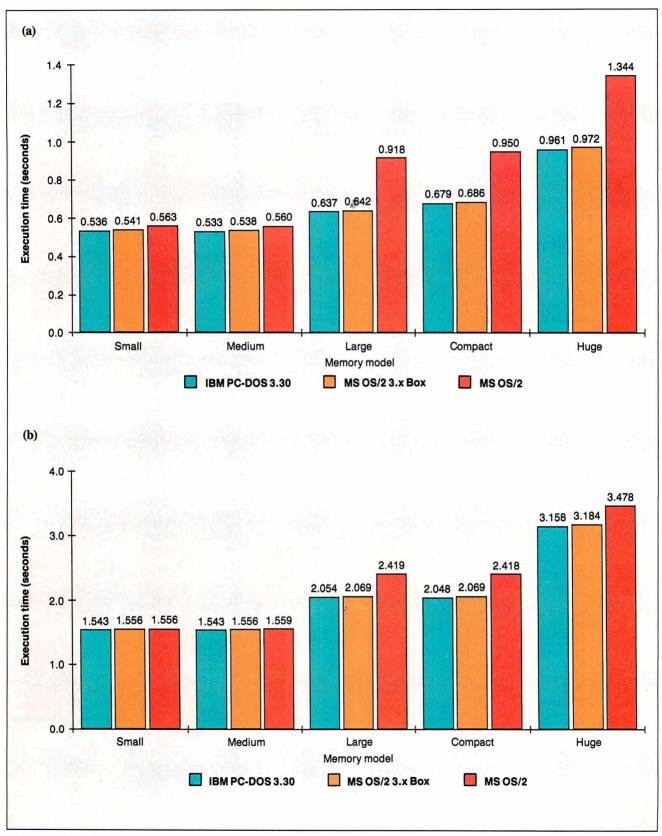


Figure 1: According to my tests with small memory models, the Sieve of Eratosthenes took somewhat longer to run in the compatibility box and in OS/2 protected mode than in DOS. Using larger memory models, however, OS/2 took as much as 44 percent longer on a 16-MHz Trillian Power Systems 386 (a), and 18 percent longer on an 8-MHz IBM PC AT (b).

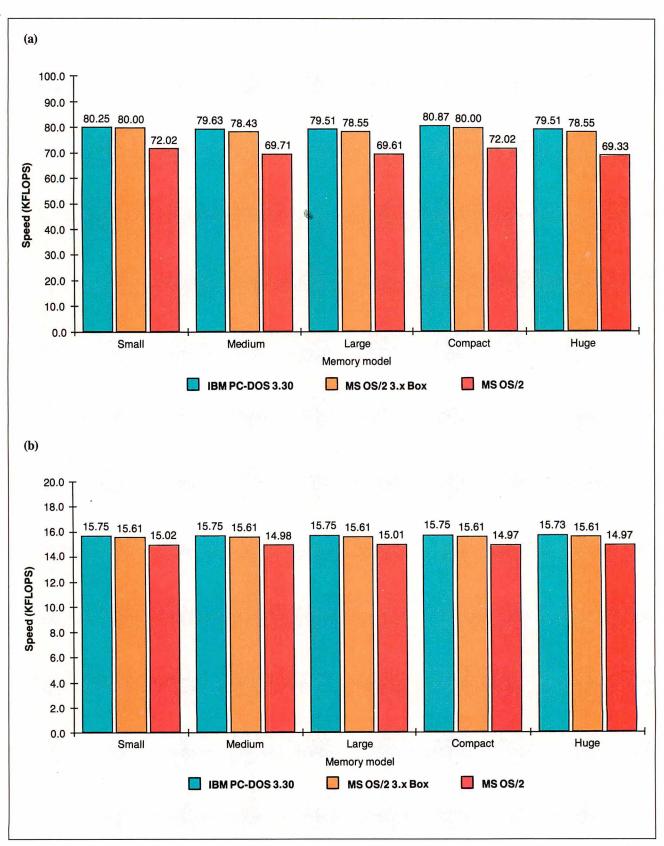


Figure 2: Floating point rate (in kiloflops) of the Savage floating point benchmark run under DOS, the OS/2 compatibility box, and OS/2 protected mode. Note that the compatibility box slowed the programs by a few percent, while OS/2 slowed them by about 10 percent on the Trillian Power Systems 386 (a), and 5 percent on the IBM PC AT (b).

Table 2: Results of UNIX benchmarks run under DOS, the OS/2 compatibility box, OS/2 protected mode, and OS/2 with an editor running in the compatibility box in the foreground. (Times normalized to 1.00 for DOS 3.3.)

Test name	DOS 3.3	Compat. box	Pure OS/2	OS/2 w/editor in compat. box
Copy char array	1.00	1.02	1.06	N/A
Copy char array using pointers	1.00	1.01	1.05	111.11
Loop using auto int indexes	1.00	1.01	1.05	111.11
Loop using static int indexes	1.00	1.01	1.05	111.11
Loop using 2 register variables	1.00	1.01	1.06	104.17
Loop using 5 register variables	1.00	1.01	1.05	108.87
Int arithmetic	1.00	1.01	1.05	100.00
Long int arithmetic	1.00	1.00	1.05	90.91
Float arithmetic	1.00	1.03	1.16	100.00
Double arithmetic	1.00	1.06	1.14	142.86
Address arithmetic w/char ptr	1.00	1.01	1.05	111.11
Address arithmetic w/struct ptr	1.00	1.01	1.05	90.91
User C function call overhead	1.00	1.00	1.04	90.91
System call overhead (getpid)	1.00	1.01	24.39	N/A
Library string length function	1.00	1.01	1.09	90.91
Library string copy function	1.00	1.01	1.08	100.00
Library string compare function	1.00	1.01	1.06	100.00
Savage floating-point test	1.00	1.01	1.10	111.11
Dhrystone general benchmark	1.00	1.01	0.88	90.91
Copy file, buffered stream I/O	1.00	1.22	1.10	111.11
Copy file, unbuff low-level I/O	1.00	1.88	1.34	N/A
Copy file, buff stream blocks	1.00	1.01	1.05	142.86
Copy file, unbuff low-IvI blocks	1.00	1.01	1.14	111.11
Seek/read in file, buf stream	1.00	1.33	1.11	200.00
Seek/read in file, unbuf low-lvl	1.00	1.54	1.23	500.00
Dummy report with qsort	1.00	1.37	1.37	22.73
Dummy report with shellshort	1.00	2.07	1.95	N/A
N/A refers to timer overflow or lack of comp	arability.			

Why return to DOS, when we have the compatibility box? Well, I'll take the matter up entirely in a later column, but basically because the compatibility box is only about 80 percent compatible with DOS, and because it severely restricts your working space (maximum available memory is not 640K bytes, but about 530K bytes). Take my advice: Don't burn the DOS manual yet.

The answer: Partition your hard disk drive into C and D drives, using the DOS FDISK command. Format the separate drives. Put your DOS data on drive D, and set up OS/2 to boot from drive C. There is no way to FORMAT D:/S under DOS, but the next best thing is to create a separate boot floppy disk. Just put your usual AUTOEXEC.BAT file on it, then add the lines

set comspec=d:\command.com

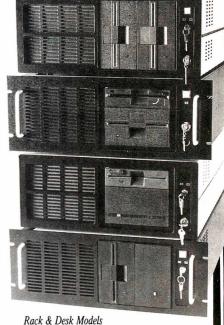
and you're all set. Then write IBM a letter demanding the dual boot feature in the next release of OS/2.

Next month, I'll take a look at multitasking benchmarks: benchmarking OS/2 against itself. ■

Mark Minasi is a managing partner at Moulton, Minasi & Company, a Columbia, Maryland, firm specializing in technical seminars. He can be reached on BIX as "mjminasi."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Integrand's new Chassis/System is not another IBM mechanical and electrical clone. An entirely fresh packaging design approach has been taken using modular construction. At present, over 40 optional stock modules allow you to customize our standard chassis to nearly any requirement. Integrand offers high quality, advanced design hardware along with applications and technical support all at prices competitive with imports. Why settle for less?

## Rack & Desl



Accepts PC, XT, AT Motherboards and Passive Backplanes

Doesn't Look Like IBM

Rugged, Modular Construction

Excellent Air Flow & Cooling

Optional Card Cage Fan

Designed to meet FCC

204 Watt Supply, UL Recognized

145W & 85W also available

Reasonably Priced

## RESEARCH CORF

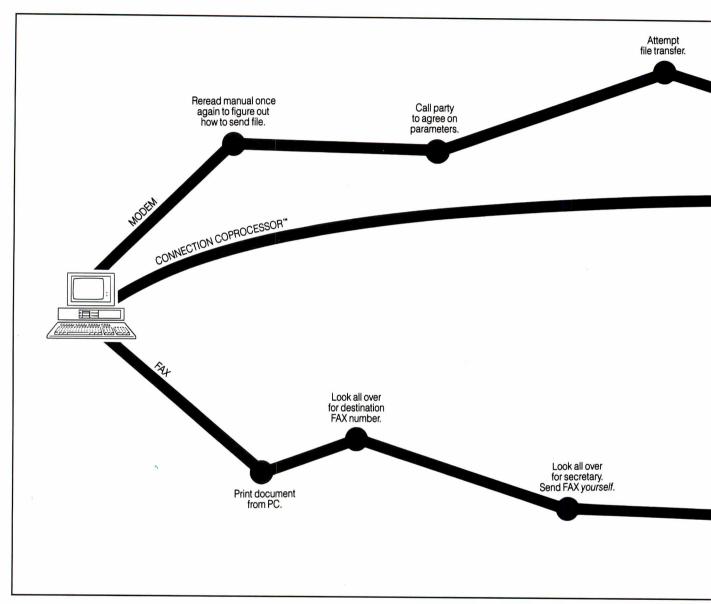
Call or write for descriptive brochure and prices: 8620 Roosevelt Ave. • Visalia, CA 93291 209/651-1203

> TELEX 5106012830 (INTEGRAND UD) EZLINK 62926572

We accept BankAmericard/VISA and MasterCard

IBM, PC, XT, AT trademarks of International Business Machines Drives and computer boards not included.

## Intel announces



Announcing the first non-stop communications route between businesses anywhere in the world.

Intel's Connection CoProcessor.™

It's a whole new way to send and receive programs, files, text, graphics and electronic messages. Not just between PCs, but with fax machines as well.

The Intel Connection is a new communications coprocessing board that frees your PC from the task of communicating.

Which means you can work on your computer non-stop — even while

sending a document as big as the New York phone book.

Now your faxes or files can fly cross country. And you can still be zooming around in your flight simulator. Or writing that letter to your biggest account. Or recalculating your spreadsheets for tomorrow's meeting. Without interruption or downtime.

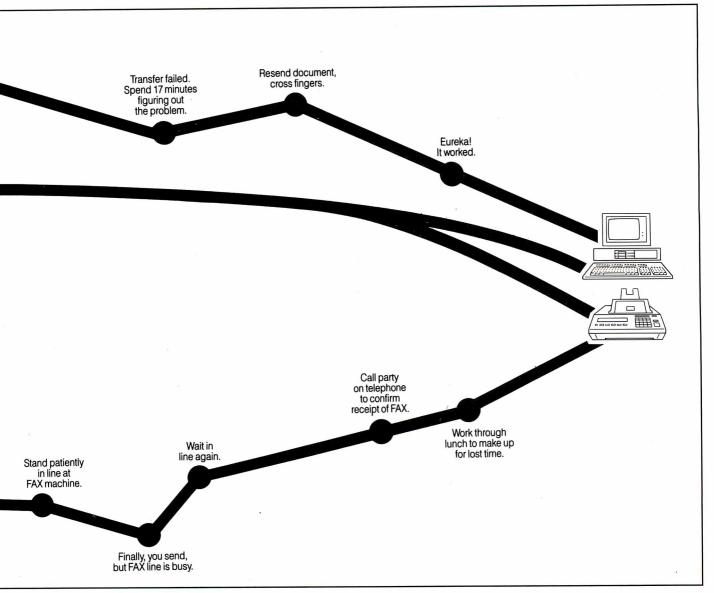
And when you fax, there are no more stopovers at the printer, or cooling your heels in line at the fax machine. Because Connection lets you do everything without leaving your PC.

And when you send files directly to



©1988 Intel Corporation. Connection CoProcessor is a trademark of Intel Corporation. WordPerfect is a registered trademark of WordPerfect Corp. Ashton-Tate is a registered trademark of Ashton-Tate Corporation. Borland is a registered Microsoft is a registered trademark of Microsoft Corporation. \*CAS (DCA/Intel Communicating Application Specification.)

# non-stop flights.



another Connection-equipped PC, you won't have to fiddle around with modem parameters or protocols. Because the Connection CoProcessor sets them for you. At 9600 bps.

Best of all, Connection supports CAS,\* a new communication standard that is supported by major software and hardware developers like Ashton-Tate,\* Borland,\* DCA,\* Microsoft,\* and WordPerfect.\* Which means you can send, for example, a word processing file to your London office, without ever exiting your WordPerfect program.

You just send the document directly from your application. That's it. There isn't any complicated

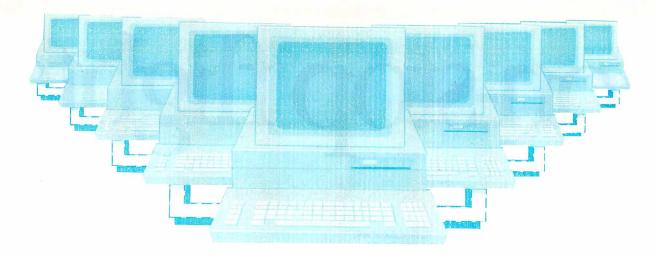
communications software to learn.

And everything is backed by toll-free technical support and a five-year warranty from Intel.

So what are you waiting for? Call 800-538-3373 now for a free demo disk.

Because with Intel's Connection CoProcessor, communication is really going to take off.





## Tomorrow's LAN Solutions — Today. EtherLAN Plus"/The Affordable Ethernet Solution

In today's LAN world, every new LAN manufacturer seems to have a new idea of what a network should be. Standards for the industry are few and far between, but are there if you want to pay for them. Wouldn't it be nice if for once you could buy a LAN system, at a price you can afford, and be fully compatible with the ethernet standard? Well now you can!

#### **Turn Key Ethernet**

EtherLAN is here to give you everything you need to set up an ethernet LAN system. You'll receive the EtherLAN network adapter. 25 feet of thinwire ethernet coax cable, T connector and easy to understand Installation and User's Guides, all for one low price. In addition to this, you'll also receive complete software needed to get your new EtherLAN system up and running quickly. You'll get NETBIOS software and also a complete network operating system to make using your new EtherLAN system even easier.

#### SimpleWARE Makes EtherLAN Unbeatable

The operating system you'll get works as a shell above DOS, so all your normal DOS programs will run on EtherLAN as well as locally.

144B BYTE • OCTOBER 1988

Even better yet, you can use standard DOS commands to control your network, so you are not stuck spending hours to learn a new set of commands. The operating system functions transparently, so you won't even know you're on a network.

#### Features You Can Rely On.

- Fully ethernet and cheapernet compatible (IEEE 802.3).
- Fast a full 10,000,000 bit per second.

**EtherLAN 6 Node Comparison** 

11 and 10 seconds

14 and 12 seconds

Read and Write

Novell SFT® 10 and 9 seconds

500 Kbytes

3Com®

EtherLAN

\*Figures from PC Magazine.

- Low memory requirements.
- NETBIOS compatible.
- Everything you need is included at one low price.

#### The best news of all is the price.

At only \$699.95 per node, you get all hardware, software, cabling and manuals needed.

#### **Introductory Offer**

Four Node Kit for only \$2499.00. Save over \$300.00.

With features like these, and an affordable price per node, how can you lose?

 NO dedicated servers are required.

• Transparent operation —operates as a shell above DOS.

- Easy to use DOS type commands or pop up menus.
- Share disks, subdirectories, printers and plotters.
- DOS file and record locking.
- Up to 5 printers per server.
- Time and Date sharing.

Electronic Message System.

Call Toll Free 1-800-262-8010 1-714-529-8850 (in CA)



Retail

\$4199

\$5670\*

\$8265\*

VISA, M/C, COD, or Prepaid orders accepted.



#### See us at COMDEX Booth #B1540 Simple Net Systems, Inc.

545 W. Lambert Rd., Suite A Brea, CA 92621 FAX: (714) 529-2413

Requires IBM PC/XT/AT or compatible, running DOS 3.10 or higher. EtherLAN is a registered trademark of Simple Net Systems, Inc. Other brand and product names are trademarks of their respective holders.

Circle 239 on Reader Service Card (DEALERS: 240)



## BACK TO THE FUTURE AGAIN

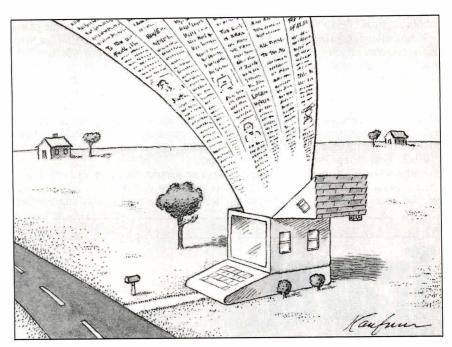
Will Prodigy, the latest incarnation of computer conferencing for the masses, bring information services to a home near you?

n the 1950s, futurists claimed that people in the 1980s would be commuting from their rooftops via personal helicopters, filing flight plans instead of fighting freeways. In 1959, U.S. Postmaster General Arthur E. Summerfield predicted, "Before man reaches the moon, your mail will be delivered from New York to California, to India, or to Australia by guided missiles. We stand on the verge of rocket mail."

History ultimately betrayed these predictions. Certainly in today's high-tech, ultrahip global village, such outlandish predictions would not be foisted on the public, would they? Don't believe it at all. Let's go back to the future for a minute

It's early in the 1980s, and the burgeoning information age is being hyped by two videotex systems: Times Mirror's Gateway and Knight-Ridder's Viewtron. A perfect marriage, or so it seemed. The parent companies dealt in delivering information. They thrived on it. So now they sought to launch the next wave in information delivery: news and assorted esoteric services delivered via your TV.

However, both services flamed out. They were victims of high operating costs, perplexing user interfaces, and—most of all—flaccid consumer response. These companies should have known better than to make the American family choose between reading the day's headlines and watching M\*A\*S\*H (reruns notwithstanding). M\*A\*S\*H won hands down.



**Back to the Drawing Board** 

Still, the idea of electronically delivered services, accessible from the comfort of your home, is a good idea. And a good idea has a way of hanging around until the time is right. Say hello to a good idea: Prodigy, the information-age equivalent of personal helicopters (easing daily tasks) and rocket mail (offering effective and inexpensive communications).

"We see our major competition being the traditional way people go about doing their everyday tasks," says Robert Caviglia, Prodigy's branch sales manager in the San Francisco area. There is a small catch. Prodigy's success is directly linked to the infiltration of microcomputers into the American home. By industry estimates, there are roughly 13 million of them in homes today, with slightly over 1 million of those hooked to a modem. Prodigy believes the American home is just now beginning to realize that having a microcomputer is more than a novelty.

"People aren't afraid of the PC anymore," says Dave Waks, Prodigy's director of technology and a charter member of its development team. "We are a service for people who want to use the PC to accomplish things, to make their lives easier, use their time better, gratify themselves, educate themselves."

#### Making the Future Work

With a work force of some 750 people, the Prodigy team has cleared extensive technical hurdles (like building its own network to carry Prodigy services) and is now working on attracting the paying customer. Three initial markets were chosen in June: San Francisco, Atlanta, and Hartford, Connecticut.

There are two prime factors in Prodigy's success equation: price and performance. Pricewise, a flat fee of \$9.95 per month allows you unlimited access to the service. This "all you can eat" fee may be Prodigy's savior. Other on-line ser-

vices charge on a per hour basis. If you use Prodigy just for its electronic mail, you'll more than make up the \$9.95.

And for that flat fee, you get up to six accounts. That means six different people can use the system for the same price. Each account has a different ID number.

Prodigy's ability to offer a low rate stems from two factors. First, its low rate is largely subsidized by more than 80 national companies, each paying upward of \$20,000 for the privilege of advertising to Prodigy users. It's a captive market: When you shift to a different screen, a new inescapable ad pops up along the bottom six lines of your screen.

Some critics decry these ads as a violation of personal screen space, as if screen space were sacrosanct. Prodigy executives offer no apology. Part of their role, they say, in helping to make people's lives easier and more efficient is the offering of services or products tailored to an individual's interests. The extent of this ad tailoring depends on the user.

When first using Prodigy, you are given the option of filling in a detailed interest summary. The more specific you get, the better Prodigy is able to tailor

what kind of ads show up on your screen. This tailoring raises the specter of privacy violations. Will Prodigy be able to track my individual purchasing habits? Will my interest survey be sold to hundreds of commercial companies trolling for new customers? "No," says Brian Ek. "The surveys are completely confidential and will not be used for anything beyond gathering statistics to show to potential advertisers. No names are used, no personal information released."

Should an ad pique your interest, you can instantly get more information simply by pressing the L key and diving into a window that further explains the product. This is a handier way of gaining more information on a product than filling out one of those ad cards found in magazines. Besides, filling out those cards usually lands your name on *someone's* mailing list, and who needs their name on another mailing list? And if you find you really like the product you're looking at, you can order it right on the spot.

The second factor in Prodigy's low price is how it approaches performance. Rather than depending on a dumb termi-

nal, where the user is a slave to the remote system, Prodigy makes the PC the master; the system is the slave.

Prodigy's design takes full advantage of the intelligence built into the PC. (Currently, Prodigy is available only for the IBM PC and compatibles. Apple II owners will have access later this year, and Mac owners early in 1989.) All the information needed to navigate and retrieve information from Prodigy is stored in the PC.

If you're doing something on Prodigy and the information to perform that task isn't stored on your PC, only then does it query a remote computer, usually the local Prodigy site. "Your computer grabs the information it needs and stores it for future use," says Waks. In this sense, the system actually gains performance the more you use it. If the local site doesn't have the information you need, it then queries the main database in White Plains, New York.

"But the nice thing about the local host accessing the White Plains computer is that it stores the information you've asked for and can deliver it on demand to

continued

# Travel With A Fast Crowd.

Wherever your business takes you, take along the WorldPort 2400™ Portable Modem. Leaving the office doesn't have to mean leaving behind the world of high-speed, 2400 bps communications. Worldwide, in virtually every situation, including hotel rooms and phone booths, your ability to communicate clearly and efficiently remains intact.

Representing the cutting edge of modem technology, the WorldPort line of portable modems combine a broad range of features that bring you the best value in modems today. Features

that go far beyond costly internal units, such as Bell and CCITT standards, direct connect and acoustic interface (300 and 1200 bps), battery power, shirt pocket size, and a tiny price.

In fact, the WorldPort modems are the ultimate for both portable and desktop applications. And the WorldPort 2400 comes with Carbon Copy PLUS™ communications software, for even greater value.

If you want a modem that works where you do, put the WorldPort Series to work for you. In

the office. On the road. Or at home. For more information about our full line of WorldPort modems, or the name of your nearest dealer, call us at 800-541-0345. (In New York, 516-261-0423.)



Touchbase Systems, Inc. 160 Laurel Avenue Northport, NY 11768 (516) 261-0423 TELEX: 6502848020 FAX: (516) 754-3491

WorldPort 2400 is a trademark of Touchbase Systems, Inc. Carbon Copy PLUS is a trademark of Meridian Technology, Inc.



## **NO OTHER DESKTOP** PUBLISHING SYSTEM OFFERS THIS FEATURE.

With the new Mannesmann Tally® Universal™ Publishing System, you can practically fly.

Thanks to a Raster Image Processor board that plugs directly into your PC or compatible, you'll process your pages at a speed limited only by the speed of your computer. Not—as is typical—at the speed of the printer. And you'll transfer ready-to-print data directly to the printer through a video interface at an incredible 3-million bits per second.

So when you're using the PostScript® compatible interpreter, you'll produce a printed page almost twice as fast as most other systems. But that's just ground speed.

If you use Aldus® Page-Maker or Ventura Publisher, you'll



1. Universal Publishing System (includes a PostScript compatible interpreter and Document Description Language (DDL)) 2. DDL Publishing System (DDL only).

■ Resolution: 300 x 300 dpi.

- Emulations: Both systems include HP\* LaserJet.
- Memory: 2 Mg.
  Typefaces: UPS includes 35 typefaces, DDL System includes 22 typefaces.
- Speed: 10 pages-per-minute.
- Dual paper cassettes standard, 250 sheets
- Dual output bins standard, 250 sheets each. ■ Manual feed handles single sheets, envelopes, transparencies, and labels.
- Workload: 10,000 pages-per-month.

really take off. Because when you select DDL instead of the PostScript compatible interpreter, you'll double that speed again. And with full page bitmap graphics, you can get printed output up to 17 times as fast.

So call the number below for the name of your nearest dealer and log in your time on the New Mannesmann Tally Universal Publishing System. A pilot's license is not required.

## **MANNESMANN**

In Washington state, call: 206-251-5524 Ext. 162

Test results available upon request. PostScript is a registered trademark of Adobe Systems, Inc. DDL is a registered trademark of Imagen Corp. Ventura Publisher is a registered trademark of Ventura Corp. Pagemaker is a registered trademark of Aldus Corp.

# You'll never have to wait for a mainframe again.



Microsoft just eliminated a 3000-pound headache for mainframe programmers. With Microsoft\* COBOL Optimizing Compiler 3.0.

Now instead of endlessly waiting for mainframe time, you can bring your COBOL programs right down to the PC on your desk. Suddenly you've got control unknown in other platforms, as well as serious speed and power.

You've got full MS OS/2 support to let you break the 640K

memory barrier.

You've got fast execution because Microsoft COBOL is now a

native code compiler.

You've got a rich development environment thanks to the Microsoft COBOL Animator source level debugger, Microsoft Editor and other powerful utilities.

One final assurance. Because Microsoft COBOL 3.0 is now mainframe COBOL compatible, you'll enjoy a seamless flow of source code between mainframe and PC environments.

Feel free to also enjoy the highly technical information in the adjacent column. Then call us at 800-541-1261 for more information and the dealer nearest you.

The mainframe wait is over with Microsoft COBOL 3.0. Appearing soon on a PC near you.





#### Microsoft COBOL Optimizing Compiler Version 3.0 for MS OS/2 and MS-DOS®

## Complete COBOL Solution for Application Maintenance and Development on the PC.

 Develop and port large mainframe applications on the PC

- Break the 640K barrier with OS/2 support including dynamic link libraries and multi-thread support. NEW!
- Develop programs that run in both MS-DOS and OS/2. NEW!
- Compatible with several different COBOL dialects. (IBM® VS COBOL II,™ IBM OS/VS™COBOL, IBM SAA, Data General, and others.)
- Call Microsoft C and Macro Assembler routines. NEW!
- HUGE memory model allows data items to be greater than 64K. NEW!
- Full network support with record and file locking including Novell. NEW!

#### Powerful COBOL Development Environment

- Animator source level debugger. NEW!
- Trace execution, backtracking, breakpoint DO statements, and periodic breakpoints.
- Microsoft Editor, the programmer's editor for both MS OS/2 and MS-DOS. NEW!
- Reconfigurable and extendable editor that even lets you run your programs from within it.
- Incremental linker for MS OS/2 performs partial links up to 20 times faster than a full link – only changed modules are relinked. NEW!

#### ANSI 85 COBOL support. NEW!

- Certified HIGH by National Bureau of Standards.
- Structured language enhancements: Scope delimiters
  In-line PERFORM statement
  CALL BY CONTENT statement
  EVALUATE statement
  Negated conditions
  Global variables
  Reference modifications
  Nested programs

### Native Code compiler with fast execution. NEW!

- 10x faster computations than MS COBOL 2.2.
- 30% faster I/O than MS COBOL 2.2

another user," Waks adds.

The demonstration I was given performed flawlessly, and the full-color graphics screens were quick, even at 1200 bits per second.

#### What's Here

Prodigy has been branded with the title "Stodigy," apparently because it offers no innovation and less in the way of useful services. Nothing could be further from the truth.

True, I found the user interface too splashy for my tastes and, yes, a bit simplistic. But the system was designed to attract a mass market—to augment people's lives, not turn them into computer experts.

Will on-line veterans find any use for Prodigy? Of course. Its E-mail feature alone is worth the monthly price. And when Prodigy brings its conferencing capability on-line, in the form of specialized bulletin board-type services, the system just might attract more than a few power users.

Prodigy's mnemonic menu system (M for menu, H for help) is a welcome sight. If you don't want to deal with a menu, you can use a jump command and bypass a lot of on-screen real estate. In addition, you can set up a self-directed personal path that leads you sequentially through the system, visiting only areas of interest to you. Navigating your personal path entails only hitting the Enter key.

The system contains all the information that you'd expect on such a service: news, weather, and special information, like material from Consumer Reports. (An interesting side note: No advertising screens are visible while accessing Consumer Reports. As in the hard-copy publication, it is devoid of all ads. This tells me that Prodigy is likely to deal with future information providers concerned about what types of ads people are subjected to while accessing their particular database. Nice touch.)

Travel information is available. And soon you'll be able to order airline tickets, too.

There's a panel of 40 experts writing daily columns, from Howard Cosell on anything to Jane Fonda on fitness to Robert Novak on politics. And you can send E-mail to any of these experts, with a promised personal reply within 72 hours.

I was all set to really slam these columns as superficial until I read Novak's column. Novak wrote about the selection of a keynote speaker for the Democratic national convention. He outlined a fiery controversy over the choice. Good stuff. Tightly written in just over 80 words. But the biggest surprise: I read the same information, almost verbatim, in his syndicated newspaper column 3 days later. By using Prodigy, I had, in fact, scooped millions of newspaper readers.

You can access stock quotes on a 15-minute delay, as per SEC requirements. You can also buy and sell stocks via Prodigy and track your portfolio by using a type of personal path system for setting up a series of stock symbols.

And there's much more coming down the pike—grocery delivery, for one thing. You can imagine how welcome it will be for a San Francisco couple to simply type in a shopping list and have the order delivered at a predetermined time. No hassling with lines; no scheduling one's time around the supermarket.

There's also a wide variety of entertainment and educational services. One particularly intriguing game called GEO puts you in charge of a fictitious corporation. Over the course of a few weeks, you drive the company, making decisions about mergers, product development, and capital investment. You play against several other Prodigy users, and at the end of the game, your position is ranked with the others. It's a cutthroat game that any corporate barracuda will love.

#### Will It Work?

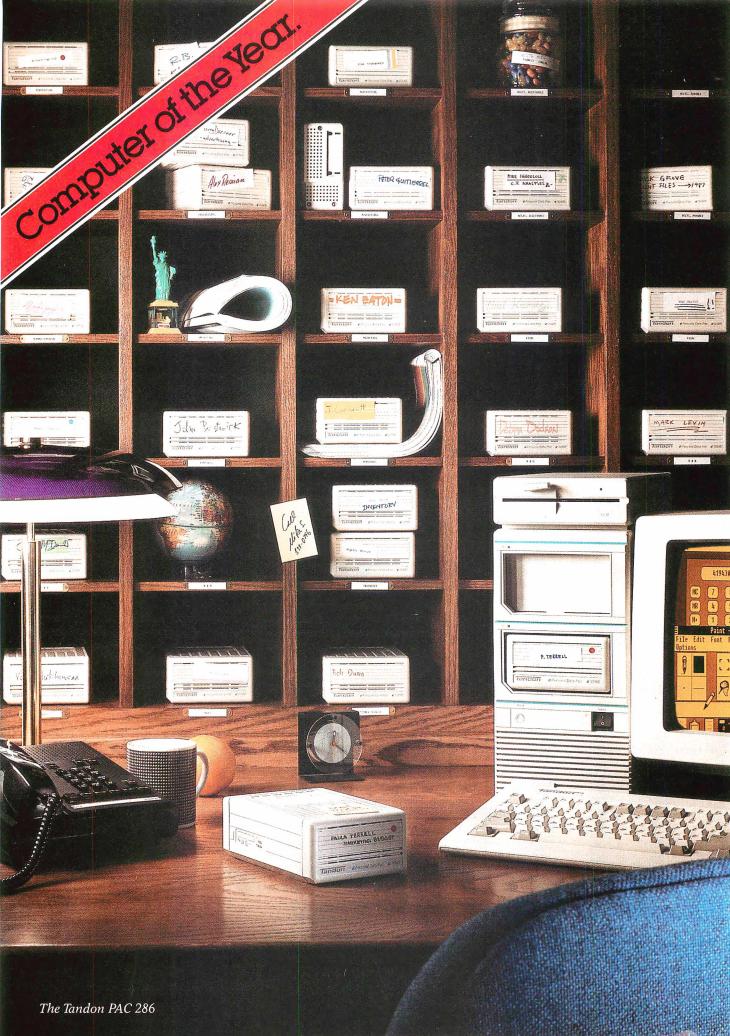
Prodigy does have its problems. The most perplexing one is that distribution of software and documentation has been terribly inadequate. People have waited months to receive their materials. Prodigy officials say this is "demand outstripping supply," but insiders cop to the real reasons: poor planning and poor choice of distributor. As of this writing the problems still exist, but word has it that Prodigy is aware of the hassle and is doing what it can to fix the mess.

Success is often a matter of definition. If Prodigy succeeds only in educating the American market to the fact that on-line electronic services are available and easy to use, it will be a success.

As for its fate vis-à-vis personal helicopters and rocket mail? Well, I suppose that's left for a columnist to write about sometime well into the twenty-first century.

Brock N. Meeks is a San Diego-based freelance writer who specializes in high technology. You can reach him on BIX as "brock."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.



# Snareal

shar'a·bl, a. [A.Sax. scearu, a portion]: The ability to let everyone in your company have their own personal computing environment without having to buy hundreds of PCs.

The dramatic improvement in personal productivity through the use of personal computers hasn't come without a substantial price tag. Buying and maintaining a PC for every user can make a real dent in the data processing budget.

But the simple fact is, the typical business PC is used less than 3 hours a day.

Now there's a simple, economical way to get the most out of your existing PCs and give every user the personal computing environment they want. It's called Personal Data Pac technology. From Tandon.

This innovative technology consists of a portable 30MB Winchester disk pack that is both small

and rugged, called the Personal Data Pac, and an external drive receptacle called the Ad-PAC. The total package will cost you less than \$1,000.00.

Provide your users with Data Pac technology and several can share a single system. And still keep their personal data personal. PCs could even be configured differently for different applications. Users would simply work at the system that fits their needs.

Installing an Ad-PAC is as simple as plugging the controller card into an expansion slot of any AT-compatible personal computer and connecting the cable. The Personal Data Pac inserts into the Ad-PAC as easily as a VCR cassette.

The Personal Data Pac provides the performance of a fixed Winchester: With an effective access time of less than 40 milliseconds, it has the fastest data throughput of any removable mass storage in recent tests. And removability doesn't mean loss of reli-

ability. The Data Pac can withstand up to 250G of shock—twice as much as other removable Winchesters—thanks to Tandon's patented clamping mechanism which locks the heads away from the disk surface.

If you still need additional processing power after all your PCs are Ad-PAC equipped, Tandon has the answer. The

Tandon PAC 286...a powerful AT-compatible unit with two built-in Data Pac receptacles.

Find out how your PCs can become more shareable. See your Tandon dealer today or call us at 1-800-556-1234, Ext. 171 (In California 1-800-441-2345, Ext. 171).



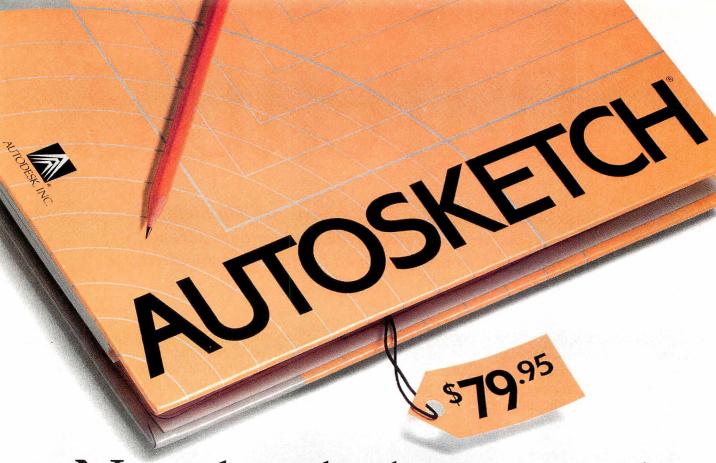
The Tandon Ad-PAC



We're redefining personal computing.

#### GSA# GSOOK87AGS6049 OPT1

Pricing and information correct at presstime. Tandon reserves the right to vary prices and specifications at any time without notice. Tandon is a trademark of Tandon Corporation.



# Now that the best name in CAD is this affordable, why settle for a generic brand?

What's in a name? When it comes to the Autodesk name, a lot. In fact, it's the best-selling, most well-respected name in the CAD business. There simply is not another company with the credentials to make that claim.

That's why you shouldn't settle for anything less than AutoSketch,® the best way to get started in CAD. AutoSketch is the precision drawing tool from the Autodesk family of products. Not only is AutoSketch priced at just \$79.95,\* but unlike some entry-level CAD products, you don't have to keep spending more to add the features AutoSketch already has. Standard features like boxes, circles, stretching, mirroring and rotating—to mathematical precision. And advanced CAD capabilities like dynamic PAN and ZOOM and automatic dimensioning and scaling, in up to 10 working layers.

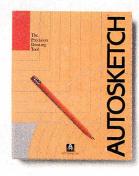
Of course, if you do want to move up from AutoSketch at some point, your files can easily be uploaded into AutoCAD.®

AutoSketch runs on IBM® PC/XT™/AT® and 100% compatible computers, and supports IBM's PS/2.™

So if you're ready for CAD, why not go with the name that rates highest among both critics and users? Anything else is, well, second-rate.

To order AutoSketch call 1-800-223-2521. For the name of your nearest AutoSketch

Dealer or for more information, call 1-800-445-5415 Ext. 1 or write to AutoSketch, 2320 Marinship Way, Sausalito, CA 94965.



#### AUTODESK, INC.

Circle 26 on Reader Service Card

<sup>\*</sup>A speed-enhanced version (9 times faster), requiring a math coprocessor, is available for \$99.95.

# Borland Beefs Up Its Languages

Turbo C and Turbo Pascal get upgrades, but the big news is an assembler and a debugger

orland International is well known for its low-cost line of development languages: Pascal, Basic, Prolog, and C. But up to now, if you really needed to get down close to the silicon by using assembly language or debugging your wayward masterpiece of code when it sporadically crashed, you had to look elsewhere. No longer: Borland has closed this breach by introducing a high-speed assembler and a powerful stand-alone debugger. If that isn't enough, the company has upgraded its premier development languages-Turbo Pascal and Turbo C-with builtin source-level debuggers.

The Turbo Assembler and Turbo Debugger are entirely new. Being a lowly assembler, TASM operates more or less in a line-oriented environment; happily, it operates noticeably faster than other assemblers. The Turbo Debugger is possibly Borland's best release of this group. Like TASM, the debugger boasts support for the complete line of 80x86 processors and 80x87 coprocessors.

Turbo C 2.0 and Turbo Pascal 5.0 feature their usual integrated development environment, which consists of the compiler itself, a WordStar-style program editor, and source code debugging capabilities. Both compilers make use of expanded memory, provide faster floatingpoint emulation, have in-line assembly language support, and support the new stand-alone debugger. If you shun this integrated environment in favor of a program editor that you're comfortable with, each Turbo language also provides a command-line-interface version.

Sound familiar? Yes, Microsoft's Quick languages give you the same option.

# Turbo C 2.0

Turbo C 2.0, like its predecessor, supports every conceivable memory model: tiny, small, medium, compact, large, and huge. It now supports the long double data type and adds new raise and signal functions. The raise function signals a hardware exception, and the signal function lets you respond to the exception, either by two predefined handlers or by your own handler. The edit buffer makes use of the Expanded Memory Specification (EMS), freeing an additional 64K bytes of RAM to compile and debug a program. An asm keyword lets you add assembly language statements directly into your C code. To use this feature, though, you'll need TASM, since Turbo C generates an assembly language file rather than a linkable object code file when you use this option.

Turbo C 2.0 comes on six 360K-byte 5<sup>1</sup>/<sub>4</sub>-inch floppy disks and requires 448K bytes of RAM and MS-DOS 2.0 or higher. It sells for \$149.95. (Contact Borland International, 1800 Green Hills Rd., P.O. Box 660001, Scotts Valley, CA 95066, (800) 543-7543 or (408) 438-8400.) We installed a beta version of the 2.0 compiler on an Epson Equity II+ with a 10-MHz 80286 processor, 640K bytes of RAM, and a 30-megabyte hard disk drive. Turbo C has no installation program: You copy the contents of the floppies to your hard disk, or just the libraries you need. Borland also sells Turbo C Professional, a \$250 package with Turbo C 2.0 and the new assembler and debugger.

When you start Turbo C, it looks a lot like Microsoft's QuickC: It has a menu bar, and you can access the menus and menu items with one or two keystrokes. The most immediate difference between version 2.0 and version 1.0 is the new Break/Watch menu, which is quite similar to QuickC's Debug menu. It lets you

set and clear breakpoints as well as set "watches." A watch is a display of a variable's contents, and the display is dynamically updated as the program runs.

The built-in debugging facilities, which operate identically for both Turbo C and Turbo Pascal, are easy to use and powerful (see photo 1). Pressing F7 single-steps you through the program source code, line by line. On a color monitor, a bright bar of color highlights the statement being executed. You can set a breakpoint by stepping the program to the statement of interest and selecting Toggle Breakpoint from the Break/ Watch menu. The source code statement thus selected is highlighted in a color different from that of the other statements, a nice touch if you're plodding through a lengthy trace. Or, you can move the editor cursor to the target statement and select Go to Cursor from the Run menu.

With the Break/Watch menu, you can also examine the contents of arrays and structures by means of a watch. The contents of the target variable are displayed and are updated as their contents change. You can have the watch variables displayed in a particular format, such as hexadecimal, decimal integer, real, character, Boolean, and pointer.

We used BYTE's C compiler benchmark to compare the performances of Turbo C 1.0 and 2.0. This benchmark is the source code to XLisp and consists of 24 files. It's compiled with the large model option. Turbo C lets you define and build "projects" that reference multiple source code files, so we set up an XLISP.PRJ file. Turbo C 2.0 compiled the project in 2 minutes, 5 seconds, versus the 2 minutes, 40 seconds required by Turbo C 1.0. The preliminary documents for version 2.0 claim that it's about 10 percent to 30 percent faster than its predecessor. The BYTE benchmark pegs it at 21 percent. We also compiled the source code for the Sieve, Sort, and Fibonacci benchmarks that were used to

evaluate Microsoft C 5.1 (see "Microsoft Languages Update," April BYTE). We were pleased to see that Turbo C accepted the processor-specific int86x() function, used to extract elapsed machine time, as coded for Microsoft C. The version 2.0 benchmarks ran as fast as those for 1.0, except for the Fibonacci, which ran 2 seconds slower.

# Turbo Pascal 5.0

Like Turbo C 2.0, the Turbo Pascal 5.0 editor can make use of EMS memory. It features the ability to generate programs larger than 64K bytes; has new built-in procedures such as Inc() and Dec; and supports several new data types, including longint, shortint, word, and the IEEE floating-point formats. It also offers compatibility with Turbo Pascal 3.0 and 4.0. An inline statement has been expanded: Formerly you could insert inline assembly language statements within Pascal source code using this keyword, but now you can declare entire procedures or functions to be of type inline. These functions then act like macro expansions: Every time the procedure/function name is encountered, all the assembly code within it will be directly inserted into the Pascal program.

Priced at \$149.95, Turbo Pascal 5.0 comes on either three 360K-byte 51/4inch disks or two 720K-byte 31/2-inch disks. The package requires MS-DOS 2.0 or higher, one floppy disk drive, and 448K bytes of RAM for the integrated environment or 256K bytes for the command-line interface. We installed a beta version of Turbo Pascal 5.0 on the same Epson Equity II+ that we used to test Turbo C. Turbo Pascal does come with an installation program that asks you several questions and then prompts you for the disks. The compiler's sourcelevel debugger is the same as Turbo C's. The \$150 Turbo Pascal Professional version, with the assembler and debugger, is also available.

For performance measurements, we compiled the source code for the Pascal/S compiler. For comparison, we did the same using Turbo Pascal 4.0. This also tested the claimed compatibility to older versions of Turbo Pascal, since the MS-DOS implementation of Pascal/S includes a Turbo3 unit. Both 5.0 and 4.0 compiled the 2074-line program without errors in about the same time: 4.8 seconds. Next we compiled the p-code interpreter for the Pascal/S program and used the newly created Pascal/S compiler to compile two example programs. We then ran the resulting p-code with the interpreter program. Both the interpreter and the programs ran without problems.

# **TASM 1.0**

One of TASM's high points is support for the 80x86 processor family, namely the

line option (or use the JUMPS directive), TASM performs automatic jump sizing. This means that when the assembler encounters a conditional jump whose target is out of range, the assembler will recode the jump as a conditional branch around a nonconditional full-segment jump. So, if you have automatic jump sizing activated and TASM encounters JNZ TARG and determines that TARG is out of the jump range, it will emit JZ \$+5 JMP TARG

bugger for \$149.95.

since the destination of an unconditional JMP instruction can be anywhere within a 64K-byte segment.

8088/8086, 80186, 80286, and 80386.

(For the 80386, though, it has no pro-

tected-mode environment similar to the

one that's provided by Phar Lap's

RUN386.) TASM also recognizes copro-

cessor op codes for the 8087, 80287, and

80387. TASM runs on IBM PC compat-

ibles with MS-DOS 2.0 or higher and

256K bytes of RAM. The assembler is

sold in a single package with the new de-

If you activate the /JJUMPS command-

TASM is equipped with the STRUCT and RECORD directives, mechanisms for defining complex data structures. These directives are available in the Microsoft Macro Assembler (MASM) as well, but TASM adds the UNION directive for defining a single location as having multityped access (this is similar to C's union). For example, the definition

```
WORDORBYTE UNION
                        ?
BYBYTE
           DB
                        ?
BYWORD
           DW
WORDORBYTE ENDS
LOCATION
          WORDORBYTE
                      <?,?>
```

lets you reference LOCATION as either a word or a byte. So, you could use MOV [LOCATION.BYBYTE], 255 as well as MOV [LOCATION.BYWORD],30000 to store a value into LOCATION.

Perhaps TASM's biggest feature is the information contained in its 580-page user's manual. In these pages you'll find—among other things—a helpful tutorial on the pitfalls of programming in assembly language. The tips range from the absurdly simple (e.g., forgetting to return to DOS), to the mistakes we all make when we've worked late into the night (e.g., reversing operands, such as entering MOV DX, AX when you really meant MOV AX, DX), and on up to the fiendishly subtle (e.g., forgetting that,

```
File Edit Run Compile Project Options Debug Break/watch
      Line 122 Col 1
                          Insert Indent Tab Fill
                                                       Add watch
                                                                           Ctr1-F7
                                                       Delete watch
      pixel_count = (256 - pixel_count);
status = read(fh, &pixel, 1);
for (k = 0; k <= pixel_count; k++)</pre>
                                                       Edit watch
Remove all watches
                                                       Toggle breakpoint Ctrl-F8
         raster_buffer[i][j] = pixel;
                                                       Clear all breakpoints
                                                       View next breakpoint
            printf("convert_image - repeat: scan line = %d, raster byte = %d\
abort1 ("Bad MacPaint format - aborting\n");
} /* end if */
         } /* end for k */
 raster_buffer[i][j],d: 255
 pixel:
 pixel_count: 4
F1-Help F5-Zoom F6-Switch F7-Trace F8-Step F9-Make F10-Menu
```

**Photo 1:** Turbo C's built-in debugging facilities highlight the statement being executed. At the bottom, you can see variables that are being "watched" and their contents. You can examine the contents of an array row, or an individual cell in the array. Also note that you can specify the output format of the displayed data.

after a string-manipulation instruction using a REP prefix, the SI and DI registers are left pointing one element away from the last address processed).

We were also impressed by the chapters on interfacing assembly language to Borland's Turbo C, Turbo Pascal, Turbo Basic, and Turbo Prolog. Each section covers parameter-passing conventions, register-passing conventions, and coping with processor segmentation.

We tested a beta version of TASM using the source code for the 8088 version of BYTE Small-C, which consists of four files ranging in size from 28K bytes to 65K bytes. Table 1 shows how TASM fared against MASM 5.0. As you can see. TASM is an average of 2.5 times faster than MASM.

We also used the Turbo Linker, TLINK, to create the executable code for the Small-C compiler. This required that we link the TASM-generated object files together with the run-time library file, which we had created some time ago with Microsoft's library manager. TLINK readily accepted the run-time file, and we had a running version of BYTE Small-C in much less time than it had taken before.

# Turbo Debugger

Now that you have all these languages so you can grind out code to your heart's content, the next requirement is obvious: a debugger to fix all the mistakes you're sure you won't make.

The Turbo Debugger proudly continues the tradition of Borland windows that we've seen in the company's other language products. The debugger defines two kinds of menus: pull-down menus for activating major functions whose contents are typically static, and pop-up menus for entering information. (Macintosh programmers will see the similarity with the Mac's pull-down menus and dialog boxes.) Although the Turbo Debugger does not have a built-in editor, you can configure it to fire up your favorite editor from a pop-up menu when you're in the midst of a debugging frenzy.

Another powerful feature of the debugger is that it's polyglot; it lets you perform source-level debugging on Turbo C, Turbo Pascal, and TASM programs. Borland says that support for Turbo Basic will be added in a future release. The capabilities of the debugger in source mode are quite extensive, particularly in that you can perform expression evaluation operations in the high-level languages from within the debugger. If you're working on a Turbo C program, you can enter complete C expressions

(including functions), even while debugging within an assembly language routine that your C program has called. This is powerful stuff, since you can view the contents of a memory location cast as you might use it in a C expression. For example. (long far \*) 0x4000::14 lets you view the contents of memory location 14 in segment 4000 hexadecimal as though it were a far pointer.

For Turbo Pascal, the debugger can evaluate the language's full syntax with the exception of string concatenation and set operators. Finally, Turbo Debugger can evaluate the complete assembler syntax when you're debugging TASM programs. You can even modify executables created by Microsoft LINK to work with Turbo Debugger.

To run Turbo Debugger, you need DOS 2.0 or higher, 384K bytes of RAM, and an 80-character screen. Borland recommends that you have a hard disk drive, though the company says that a dualfloppy system works fine. If you want to use Turbo Debugger on one of Borland's other language products, you'll need the following versions: Turbo Pascal 5.0, Turbo C 2.0, or TASM 1.0.

When you activate Turbo Debugger, it loads the program to be debugged, opens the module window, and positions a pointer to the start of the file. From here you can move around in the source code, set breakpoints and watchpoints, and do much of what you can in the integrated source-level debuggers described already. What's new is that you can open Turbo Debugger's CPU window and step down a level into the real insides of the system.

The CPU window is made up of five components, called "panes." The code pane shows assembly language instructions intermixed with their generating high-level expressions (if you're debugging the output of a high-level language).

Table 1: Test results show that TASM easily outperforms Microsoft's MASM on the benchmarks. All times are in seconds.

Filename	TASM 1.0	Microsoft MASM 5.0	Source file (bytes)
CC1.ASM	7.24	18.53	65,128
CC2.ASM	5.34	13.17	44,318
CC3.ASM	7.03	18.93	65,323
CC4.ASM	4.33	9.42	28,043

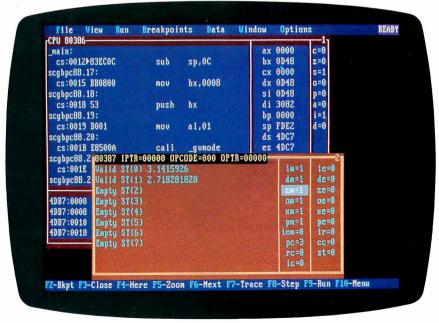


Photo 2: Turbo Debugger's numeric coprocessor window lets you dive into your system's floating-point unit (in this case, an 80387). Notice that you can enter numbers directly into the coprocessor's registers.

Inside the stack pane you can see the contents of the word at the current stack pointer, as well as one word above and below.

The data pane displays a hexadecimal dump of a selected region of memory. Typically, you use the data pane to watch blocks of memory in your data segment for activity, but you can set this pane to view anywhere in system memory. You can also alter the data pane's display format to be hexadecimal bytes, hexadecimal words, long hexadecimal integers (the C long data type and the Pascal longint type), 8-byte decimal integers (the Pascal comp type), short floatingpoint numbers (scientific notation), 6byte real numbers, 8-byte double numbers, or 10-byte extended floating-point numbers.

The registers pane provides a continuously updated display of the CPU registers, while the flags pane shows the state of each of the CPU's flags. And yes, if you select either the registers or flags pane, you can muck around with the processor's internals all you want.

Each pane has its own pop-up local menu. For example, in the code pane's local menu, you can select the FOLLOW command to see where a jump instruction will go if the jump is taken. You might also be debugging inside a subroutine and want to know what function called that subroutine; use the CALLER command.

If you've got a math coprocessor installed in your system, Turbo Debugger will sense its presence and let you activate a numeric coprocessor window (see photo 2). This window is similar to the CPU window in that it lets you probe the internals of the floating-point unit; you can examine and interactively modify the floating-point registers, as well as the coprocessor's status and control flags. This feature is unique among debuggers.

For anyone with an 80386 system with at least 700K bytes of extended memory, Turbo Debugger can operate in "virtual debugging mode." In this arrangement, the debugger loads itself into extended memory and operates your program from protected mode—which means that whatever you're debugging has free run of the lower 640K bytes. It also means that you can't run a virtual debugging session with software that uses the 80386's virtual or protected modes (such as DESQview, Windows/386, and Compaq's EMS simulator).

The Turbo Debugger's main attraction is its remote debugging (see photo 3). Anyone who has used CodeView to debug a graphics program and gone dazzle-happy while it flipped the screen from mode to mode will appreciate remote debugging. Simply put, you hook two machines together via serial ports. One is the debugging station, from which you execute Turbo Debugger as you normally would. The other is the remote target, on which the program under question executes, shepherded by a small program (about 20K bytes long) named TDREMOTE that communicates with the debugging station. In this way, the program's keyboard input and display output take place on the target, circumventing the annoying interleave of debugger I/O with the debuggee I/O. This is also handy if you're developing a software monster that's too big to crowd into memory with Turbo Debugger running stand-alone.

The remote link can operate at three data transfer rates: 9600 bits per second, 40,000 bps, and 115,000 bps. With a beta version of the debugger, we ran a quick remote session between a 4.77-MHz IBM PC XT clone and a 10-MHz PC AT clone and were surprised to see that they operated flawlessly at the highest data transfer rate. Borland also provides a remote file-manipulation program, TDRF, that you can operate from the debugging station to copy files between the machines, delete files on the target, create subdirectories on the target, and more.

# Faster Development through Better Debugging

A lot of program development is not so much how fast you can write code, but how fast you can get it converted into machine code. To that end, compiler writers have boosted the throughput of their compilers wherever possible. However, what's overlooked at times is that a significant part of developing a program is making sure the code you wrote works. It's no good having a fast compiler if you spend most of your time tracking down a bug rather than writing useful code.

The Turbo C and Turbo Pascal upgrades are significant as good debugging tools. As far as compilation speed goes, the improvements are minor. However, now you can single-step through source code statements with a keystroke and display a variable's contents in any format. With that type of debugging ability, the performance of these development languages has improved indeed.

The only surprise to TASM is that it took Borland this long to create it. It has everything you'd expect in an assembler, and it's faster than MASM. The documentation is loaded with interfacing details and probably makes the purchase price worth it.

On the other hand, the Turbo Debugger is a pleasure to use. Its ability to connect seamlessly with other Borland languages, along with its chameleon-like countenance—the capability to operate stand-alone, in virtual 80386 mode, or remotely—should put it high on any programmer's shopping list.

Rick Grehan and Tom Thompson are BYTE senior technical editors at large. You can reach them on BIX as "rick\_g" and "tom\_thompson."



**Photo 3:** Remote debugging with Turbo Debugger. The machine on the left is executing the BYTE low-level graphics benchmark program, controlled via a serial connection with the machine on the right running the debugger.

# 1024X768

# plus: VGA EGA MDA HERCULES on: STANDARD MULTISYNC monitors

Yes! the Phenomenal VGAWONDER does it all at IBM Hardware level compatibility with automatic monitor detect and no dip switches or jumpers to set. A HOT CARD for the 286/386 POWER USER with AUTO BUS DETECT for 8 or 16 bit slots, running with a 16 bit datapath with 1:1 interleave. 100% IBM HARDWARE LEVEL COMPATIBILITY means that ALL software and operating systems designed for IBM systems will run. 1024 WILL BE DISPLAYED IN COLOR ON STANDARD MULTIFREOUENCY

Although these features are expected from ATI they are NOT AVAILABLE from other manufacturers. EGA on all monitors including RGB & TTL means a perfect card for networks. MOUSE ON BOARD! ATI built the mouse right in to this one, why not? No extra charge! 16-bit datapath for those FAST speeds required at high resolutions. VGAWONDER is available in both

512K and 256K Versions. Ask your dealer for more information.



\$49900
VGA WONDER with 256K Video Memory

MONITORS.

	Software										
	RESOLUTION	COLOR/SHADE SPECTRUM					-				
ATI HI-RESOLUTION DRIVERS SUPPLIED	1024×768 960×720	16/256 K		1							
ATI HI-RESOLUTION DRIVERS SUPPLIED	800x600 * 640x480	256/256 K							3		
VGA	320×20 ALL 17 MODES	256/258 K		His							
EGA	640x350	16/64									
CGA	320x200	16/64									
MDA	720×348 640×400										
LINES OF TEXT			132×44	132×25	132x44	132x60	132×60	132x60	132x60		
800x600 CANN	OT BE DISP	LAYED	TTL	AGB	EGA	MULTISYNC ANALOG	IBM 8503/12/13	MULTISYNC XL/PLUS	IBM 8514		
ON 8503-12-13	10180		Monitor								

TECHNOLOGIES INC.

Technology you can Trust.

ATI Technologies Inc. 3761 Victoria Park Ave., Scarborough, Ontario, Canada M1W 3S2 Telex: 06-966640 (ATI TOR) Tel.: (416) 756-0718

Fax: (416) 756-0720

Trademarks: ATI, VGA WONDER, EGA WONDER - ATI Technologies Inc.; Multisync - NEC Home Electronics Inc.; AUTOCAD - Autodesk Inc.; WINDOWS - Microsoft Inc. GEM - Digital Research Inc.; VENTURA - Xerox Corp.; AUTOSHADE - Autodesk Inc.; IBM, VGA, EGA, CGA - International Business Machines Corp.



# QNX°: Bend it, shape it, any way you want it.

ARCHITECTURE If the micro world were not so varied, QNX would not be so successful. After all, it is the operating system which enhances or limits the potential capabilities of applications. QNX owes its success (over 60,000 systems sold since 1982) to the tremendous power and flexibility provided by its modular architecture.

Based on message-passing, QNX is radically more innovative than UNIX or OS/2. Written by a small team of dedicated designers, it provides a fully integrated multi-user, multi-tasking, networked operating system in a lean 148K. By comparison, both OS/2 and UNIX, written by many hands, are huge and cumbersome. Both are examples of a monolithic operating system design fashionable over 20 years ago.

MULTI-USER OS/2 is multi-tasking but NOT multi-user. For OS/2, this inherent deficiency is a serious handicap for ter-

minal and remote access. QNX is both multi-tasking AND multi-user, allowing up to 32 terminals and modems to connect to any computer.

**INTEGRATED NETWORKING Neither** UNIX nor OS/2 can provide integrated networking. With truly distributed processing and resource sharing, QNX makes all resources (processors, disks, printers and modems anywhere on the network) available to any user. Systems may be single computers, or, by simply adding micros without changes to user software, they can grow to large transparent multiprocessor environments. QNX is the mainframe you build micro by micro.

PC's, AT's and PS/2's OS/2 and UNIX severely restrict hardware that can be used: you must replace all your PC's with AT's. In contrast, QNX runs superbly on PC's and literally soars on AT's and PS/2's. You can

run your unmodified QNX applications on any mix of machines, either standalone or in a QNX local area network, in real mode on PC's or in protected mode on AT's. Only QNX lets you run multi-user/multitasking with networking on all classes of machines.

REAL TIME QNX real-time performance leaves both OS/2 and UNIX wallowing at the gate. In fact, QNX is in use at thousands of real-time sites, right now.

DOS SUPPORT QNX allows you to run PC-DOS applications as single-user tasks, for both PC's and AT's in real or protected mode. With OS/2, 128K of the DOS memory is consumed to enable this facility. Within QNX protected mode, a full 640K can be used for PC-DOS.

ANY WAY YOU WANT IT QNX has the power and flexibility you need. Call for details and a demo disk.

## THE ONLY MULTI-USER, MULTI-TASKING, NETWORKING, REAL-TIME OPERATING SYSTEM FOR THE IBM PC, AT, PS/2, THE HP VECTRA, AND COMPATIBLES. Multi-User

10 (32) serial terminals per PC (AT). Multi-Tasking 64 (150) tasks per PC (AT).

Networking 2.5 Megabit token passing.

255 PC's and/or AT's per network. 10,000 tasks per network. Thousands of users per network.

**Real Time** 3,200 task switches/sec (AT). Message Fast intertask communication **Passing** between tasks on any machine. Flexibility

C Compiler Standard Kernighan and Ritchie.

Single PC, networked PC's, single PC with terminals, networked PC's with terminals. No central servers. Full sharing of disks, devices and CPU's

PC-DOS PC-DOS runs as a QNX task.

From US \$450 Cost Runtime pricing available.

For further information or a free demonstration diskette, please telephone (613) 591-0931.

Quantum Software Systems Ltd. • Kanata South Business Park • 175 Terrence Matthews Crescent • Kanata, Ontario, Canada • K2M 1W8 Circle 218 on Reader Service Card

# Presentation Manager and LAN Manager

A graphical interface and network support carry OS/2 well beyond the traditional DOS environment

Il the pieces are starting to fall into place for OS/2, and the nearly completed system is beginning to look pretty impressive. In addition to the primary benefits of multitasking and seemingly limitless program memory, the Standard and Extended Edition 1.1 versions of OS/2 offer features that enhance usability, add functionality, and even point to a new standard for both user and programmer interfaces

One of the most eagerly awaited features of DOS's heir apparent is the Presentation Manager, a graphical user interface scheduled to be included with Standard Edition 1.1 and released this month.

The LAN Manager, slated for release with Extended Edition 1.1, adds network support to the communications and database management capability of the current Extended Edition.

Together, the two programs represent a new direction in operating-system design: tight integration of a consistent user interface with functions currently found only in applications packages.

**Presentation Manager** 

The phrase most often used to describe the Presentation Manager is "Windowslike," but the comparison is understated. From the user's point of view, the Presentation Manager is Windows, except now you're working on the system level and can access both applications programs and the operating system itself.

Users familiar with either Windows or the Macintosh should have no trouble getting up to speed with the Presentation Manager's point-and-click interface.

The Presentation Manager is actually a shell program that can be enabled or disabled using the PROTSHELL command in the OS/2 CONFIG.SYS file. With Standard Edition 1.1, you have the option of using either the standard OS/2 interface or the Presentation Manager.

At boot-up, you're presented with two windows: the Task Manager and the Start Programs window. These are special operating-system windows that control the session and cannot be removed. Together, these windows replace the Session Manager found in the original incarnation of OS/2, although that is something of an oversimplification—the Start Programs window allows you to begin new tasks, and the Task Manager allows you to switch between them.

Within the Start Programs window is a list of tasks that can be started by pointing and double-clicking with the mouse or by choosing Start from the Program submenu on the menu bar. Two task choices are always in the main list: OS/2 Command Prompt and OS/2 Windowed Command Prompt. Selecting these lets you enter commands at the DOS-like [C:] prompt, either in full-screen mode or within a window.

You can also select DOS Command Prompt to work in the DOS compatibility mode, but, as always, you are limited to one real-mode session. Adding programs to the list in the window is as easy as bringing up a dialog box and specifying a name and a path to an OS/2 executable file. Tasks can be grouped in the Start Programs window, and you can switch easily from group to group.

The task list also contains two system control programs: The PM Control Panel and the PM Filing System. The Control Panel gives the user control over system parameters, such as port configurations, screen colors, fonts, and country infor-

mation (such as currency, date formatting, and numbering conventions). Choosing the Filing System brings up a powerful file-management facility: It allows you to navigate through a directory tree, moving, copying, and deleting files—and subdirectories—using just the mouse. You can group files by association, change file attributes (read-only protection, archive status), and sort files using the Filing System.

The Task Manager contains only tasks that are currently running. Switching between active tasks can be done through this window or by selecting the task window with the mouse. You can also close or terminate active-task windows. The menu bar for the Task Manager offers other commands that can be used to shut down the system or to arrange windows on the screen. The shut-down choice can be used to save currently active tasks so that they will restart on boot-up. The file information is simply saved in START-UP.CMD.

# The Role of the API

Using applications in the Presentation Manager may be simple and intuitive, but writing them is a very different story. Programmers with Windows experience, like users, will feel much more at home than those used to the plain vanilla DOS environment. Even application developers just getting comfortable with OS/2 kernel programming will have to throw out much of what they know to work within the Presentation Manager shell. Of course, programs using the OS/2 kernel functions for I/O (functions beginning with the VIO, KBD, and MOU prefixes) should run from a windowed command prompt with no adjustments, but they will not take advantage of the Presentation Manager's consistent graphical interface.

Application programs are insulated from direct contact with users by the Presentation Manager's Application Pro-



Presentation Manager's graphical interface provides user-friendly multitasking.

gram Interface. The API is the underside of the Presentation Manager, providing all applications with a consistent interface in the same way that the topside provides a consistent interface to the user. From the program's point of view, there are only three kinds of output and one kind of input. The application can write either text, graphics, or dialogue information to a presentation space. The presentation space can be associated with devices (screen, printers, etc.) by the application. Input to the program comes from one source only: a message queue where the API posts messages to the program about user actions.

Four different types of devices can be associated with a presentation space. There are screen, memory, metafile, and device contexts, which allow you to access output hardware without resorting to application-specific device drivers. Of course, the screen is used for almost all program output, but sending data to a printer can be done using the same screen-display code; the application merely needs to associate the presentation space with a different device context. While graphics and text can be written to any device, dialogue information (which creates an interactive dialog box) can be written only to the screen display.

All program input comes through the message queue. Each window on the screen has its own queue, which contains information specific to that window. For example, when the user resizes a window using the mouse, the Presentation Man-

ager posts a message in the window's queue letting it know that its frame has been resized and it must update its display. Similar messages are posted when the window is moved, minimized (reduced to a bit-map icon), or terminated. Messages are processed by the application in sequential order. Windows can also send messages to each other; a good example is a scroll-bar window relaying user-selection information to the window containing the text to be scrolled.

The message-based software architecture makes writing Presentation Manager applications very much like writing applications for Windows. A Presentation Manager application must begin by registering a window class and drawing a window. Next, it must create a message queue for itself. Most of the application's time is spent in a simple message-processing loop like the following:

while (WinGetMsg(hab,msg, filter,first,last))
WinDispatchMsg (hab,msg);

A quit message in the queue causes Win-GetMsg to return a value of 0, dropping the program out of the loop. Any other message is processed by a window procedure, the real meat of the application. The window procedure is generally built around a structure like the C switch statement, where each message is handled by its own section of code.

What allows these programs to be

written in a high-level language at all is a huge assortment of standard functions and definitions, provided only (for now) by Microsoft's Software Development Kit. The functions, though readily identified (WinEnableWindowUpdate) will take any non-Windows programmer a while to become comfortable with. The header files and the window-handling routines also add a high overhead to any program; the source code for a Presentation Manager "Hello World" program can be 3.2K bytes long, and even a carefully linked "Hello" executable can be over 11K bytes.

# LAN Manager: The Missing Link

Certainly, the release of the Presentation Manager is a major step in the development of IBM's Systems Application Architecture (SAA). The ultimate goal is a standardized interface for both user and programmer, from application to application and from machine to machine. Helping to reach that goal are powerful operating-system utilities that behave toward the user like any other application. The latest of these is the LAN Manager, another key piece to the OS/2 puzzle.

While the Presentation Manager links OS/2 to the user, the LAN Manager aspires to a loftier goal: to link users to each other. Touting the promise of multitasking and transparent resource sharing, OS/2 stalks a domain once considered the exclusive province of powerful mainframe computers. Personal computers already pack the hardware punch necessary to meet the challenge; only the software gap holds them back. For the most part, the computer community shares the OS/2 vision. We only disagree on which standard will emerge. Now, finally, Microsoft lays its cards on the table.

The LAN Manager offers an interface much like the Presentation Manager's, with a system of hierarchical menus forming the user interface and the underlying API interfacing with OS/2. The user interface breaks down into four parts: the View menu, the Message menu, the Config menu, and the Status menu. The administrator can also access a fifth menu for system maintenance. A separate interface for console servers uses the same menu structure with options limited to sending messages and monitoring activity.

The user can also drive the LAN Manager directly from the command line. This not only allows batch files to automate command sequences, but it also ensures compatibility with other PC networking products such as PC-NET and

MS-NET. Microsoft, again, tries not to leave DOS behind in its grand scheme of connectivity. The LAN Manager runs in protected mode when linking to shared resources. But once connected, it can switch to the DOS environment to run MS-DOS applications.

While the user clicks through the friendly menus, the API churns away beneath the surface. In fact, many times the user won't even realize just how hard the API works. The API persistently strives for the dual goal of smooth operation and total transparency. If the user tries to send a message before loading the messenger module, the API loads it. Or suppose the user tries to access a remote disk without first connecting to the server. The LAN Manager will automatically start a session to the server, issue a Net Use command to access the shared disk, validate user-access level by submitting the user name and password specified at network start time, and then proceed with the user's original request. The user, meanwhile, sees only the response to the original request, completely oblivious to the API's work. The API will even try to reestablish a disconnected session if the user issues a command after losing the link.

DOS workstations also benefit from this intuitive interface. Workstations running Microsoft Networks version 1 or 2 cannot specify a user name or a group name-a necessary input to the LAN Manager servers running in user-level security mode. However, when the server receives the request from a DOS workstation, it automatically issues a guest user account, complete with permissions and passwords. If this account conforms to the access level requested, the LAN Manager makes the connection.

# Share and Share Alike

Whether it be messages or files or physical devices, a LAN's principle purpose is to let users share common resources. As a LAN Manager administrator, you decide who shares which resources, as well as when and how they are shared. Using the Add Share command button from within the View menu, the administrator can select the resource to be shared, assign a share name, designate a drive and path if necessary, limit the amount of users who can access the resource, issue a password, and determine how the resource can be used.

In the case of shared printers or communications devices, the LAN Manager establishes a queue to route requests through the network. The administrator



LAN Manager's menu structure makes it easy to set system parameters.

can add, delete, and reconfigure the queue, thereby retaining complete control over system requests and device access. The administrator can also establish pools of devices and route jobs to the first available device in the pool. The LAN Manager further enhances device access and priority routing by permitting more than one queue to send requests to a particular device or device pool. A series of queues, each assigned a different priority level, waits for an available device. Priority levels allow time-critical jobs to take precedence over those jobs assigned to a lower priority. Jobs with identical priority levels are processed FIFO (first in, first out). Requests within a queue can be scheduled for a specified time or date.

The network also shares disk space. The administrator can designate entire directories (to include subdirectories) for sharing or limit access to specific files. For added security, the administrator can determine which functions each user can perform. Even though a number of users may be able to access a directory on the shared disk, some of them may only be able to write files to the directory while others can delete files or change file attributes.

In addition to reading and writing files, the user, with proper permission from the administrator, can execute remote programs in server memory. In one swoop, the user shares a disk, a program, and even memory from the server. Updated files are left in the shared directory for other users in a group to access or modify.

The LAN Manager also includes a messenger service so users can send and receive messages across the network. The administrator can send messages to a group of users or to every user on the network. Each workstation is assigned a message name, and messages are usually routed via the message name, although you may also tag a message for a specific workstation or server by designating its computer name. A Pop Up option enables immediate display of a received message. The message will flash in the message box at the receiving workstation. Although the LAN Manager does not currently include a text editor for message composition, the message service will transmit files as well as short notes, so the user can compose a message on any word processor and relay the file across the network. If you wish, you can have your messages automatically stored in your message log.

Although further enhancements to the LAN Manager and the Presentation Manager will surely follow, the basic pieces of OS/2 are in place. The concept is grand, the structure inclusive, but the verdict is in the hands of the users, who must see if these final pieces of OS/2 fit into the real world.

Steve Apiki and Stanford Diehl are BYTE Lab testing editors. They can be reached on BIX as "apiki" and "sdiehl," respectively.

# The Dell System 220. Once again the critics stole the words right out of our mouth.

"The Dell System 220 runs most PC Labs system benchmark tests at speeds that would make you think you're running a 386."

"...the Dell machine is renewed evidence that the price of 286-based desktop equipment continues to drop rapidly, making such machines very attractive for daily work under MS-DOS even as they hold out the promise of running OS/2 in the future."

-WILL FASTIE, PC WEEK

"...includes a year's on-site support...in the price of the computer. This is the sweetest support deal offered by any computer vendor in the industry."

-ERIC KNORR, PC WORLD

"The hot item from a technical point of view is the System 220. This machine runs a 286 processor at 20 MHz, which is its major claim to fame."

-WILL FASTIE, PC WEEK

"...the System 220 has more going for it than just speed."

-PC WORLD



The reviews are beginning to pour in. And they read like a wish list for every power user looking to exceed the ordinary limitations of a 286 computer.

The computer everyone is praising in such glowing terms is the Dell System 220.

The first 286 computer with a clock

speed of 20 MHz.

It's totally MS-DOS® and MS® OS/2 compatible. Yet it sells for much less than you may pay for a 386† computer.

Because you buy it direct from us.

Eliminating the mark-ups and margins of computer stores.

We design and build every Dell computer right here in Austin, Texas.

We put each and every one through a comprehensive burn-in and a battery of diagnostic tests before we ship it.

And after we ship, we give you the best technical support you'll find anywhere in the computer industry.

Our technicians are on the phone from 7AM to 7PM every business day.

Almost any question you may have about a Dell system can be answered over the phone.

And, in the rare case, that your question can't be answered by an on-line technician, we'll send a Honeywell Bull technician by the next business day.

A full year of on-site Honeywell Bull service is included within the purchase price of your Dell system.

Your Dell computer also comes with a thirty-day money back guarantee.

And we back every one of our computers with a one year limited warranty on materials or workmanship.

For more information about Dell computers, read the reviews in the trade press, turn the page, review our product offerings, and call us at (800) 426-5150.

You'll like what we have to say.



TO ORDER, CALL 800.426.5150 IN THE U.S. AND CANADA

# The Dell Computer Store.

Welcome to our store.

We believe you'll find this an extremely

pleasant shopping experience.

Our sales staff is on hand to serve you from 7AM to 7PM (CST) from Monday thru Friday.

Just call (800) 426-5150 and we'll give you the technical assistance and information you need to make sure you're buying the system that's right for your needs.

Then you have the option of either a direct purchase or your company can take

advantage of our Leasing Plan.

Once you've made your choice, our Total Satisfaction Guarantee gives you thirty days from the day you receive your system, to decide if you are absolutely, totally satisfied with the product.

If you're not, simply return the system and you'll receive a full refund. No ques-

tions asked.

Your Dell computer is supported by a team of technical experts that can be reached every business day, from 7AM to 7PM (CST), simply by calling (800) 624-9896.

In most cases, any question you may have about your Dell system can be answered by one of our technicians on

the telephone.

Our technicians are also supported by Honeywell Bull service engineers who can be sent to your office by the next business day, should on-site service be required.

This optional service contract is available in over 95% of the United States, with over 1,000 engineers in 198 service locations.

We also offer a One Year Limited Warranty,\*\* which warrants each system we manufacture to be free of defects in materials and workmanship for one full year.

Feel free to call or write for the complete terms of our Honeywell Bull Service Contract, Guarantee and Warranty. Dell Computer Corporation, 9505 Arboretum Blvd., Austin, Texas 78759-7299.

# THE NEW 20 MHz 386† SYSTEM 310.

The top of the line. It's our highest performance computer available, faster than the IBM† PS/2† Model 80 and the Compaq† 386/20. It runs at 20 MHz with the latest 32-bit architecture. Since it also has Intel's Advanced 82385 Cache Memory Controller, and high performance disk drives, the System 310 is ideal for intensive database management, complex spreadsheet development, CAD/CAM, desktop publishing or performance as a network file server.

# Standard Features:

- Intel† 80386 microprocessor running at 20 MHz.
- 1 MB of RAM (640K usable) expandable to 16 MB without using an expansion slot.
- Advanced Intel 82385 Memory Controller with 32 KB of high speed static RAM.
- Socket for 20 MHz 80387 or Weitek coprocessor.
- 5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
- Dual diskette and hard disk drive controller.
- Enhanced 101-key keyboard.
- ■1 parallel and 2 serial ports.
- 200-watt power supply.
- 8 expansion slots (6 available).

# Performance Enhancements (Systems 310 and 220):

384 KB of dedicated RAM is used by portions of the system software for increased performance.

\*\*Lease for as low as \$148/Month.

System 310	With Monito	or & Adapter
Hard Disk Drives	VGA Mono	VGA Color Plus
40 MB – 28 ms	\$4,099	\$4,399
90 MB – 18 ms ESDI	\$4,899	\$5,199
150 MB – 18 ms ESDI	\$5,399	\$5,699
322 MB – 18 ms ESDI	\$7,399	\$7,699



# THE NEW 20 MHz 286 SYSTEM 220

As fast as most 386 computers, at less than half the price—more power for the money than any other system. An 80286 system that runs at 20 MHz, with less than one wait state. Completely compatible for both MS-DOS® and MS® OS/2 applications (it runs faster than IBM PS/2 Model 80), and with a remarkably small footprint, the System 220 is the ideal executive workstation.

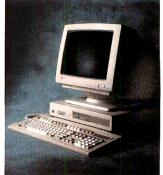
# Standard Features:

- 80286 microprocessor running at 20 MHz.
- 1 MB of RAM (640K usable) expandable to 16 MB (8 MB\* on system board).
- Page mode interleaved memory.
- Integrated diskette and VGA video controller on system board.
- One 3.5" 1.44 MB diskette drive.
- Integrated high performance hard disk interface on system board.
- Enhanced 101-key keyboard.
- ■1 parallel and 2 serial ports.
- LIM 4.0 support for memory over 1 MB.
- Three full-sized AT† compatible expansion slots available.
- Socket for 80287 coprocessor.

# **Options:**

- External 5.25" 1.2 MB diskette drive.
- 3.5" 1.44 MB diskette drive.
- Intel 80287 coprocessor.
- 1 MB RAM upgrade kit. \*\*Lease for as low as \$85/Month.

	W	ith Monit	or
System 220	VGA Mono	VGA Color	VGA Color Plus
One Diskette Drive	\$2,299	\$2,499	\$2,599
40 MB – 29 ms Hard Disk	\$2,999	\$3,199	\$3,299
100 MB – 29 ms Hard Disk	\$3,799	\$3,999	\$4,099



# THE 12.5 MHz SYSTEM **200.**

A great value in a full-featured AT compatible. An 80286 computer running at 12.5 MHz, this computer is completely MS-DOS and MS OS/2 compatible. The System 200 offers high speed drive options, industry standard compatible BIOS and on-site service. As Executive Computing said of this computer's predecessor, "If faster processing speed and low cost are two key issues affecting your purchase decision, this machine might be the ideal choice for your office."

# Standard Features:

- Intel 80286 microprocessor running at 12.5 MHz.
- 640 KB of RAM expandable to 16 MB (4.6 MB\* on system board).
- 5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
- Dual diskette and hard disk drive controller.
- Enhanced 101-key keyboard.
- ■1 parallel and 2 serial ports.
- 200 watt power supply.
- Real-time clock.
- 6 expansion slots. (4 available with hard disk drive controller and video adaptor installed).
- Socket for 8 MHz 80287 coprocessor.

## **Options:**

- 512 KB RAM upgrade kit.
- 8 MHz Intel 80287 coprocessor. \*\*Lease for as low as \$78/Month.

System 200	With Monitor & Adapter								
Hard Disk Drives	VGA Mono	VGA Color Plus							
40 MB – 28 ms	\$2,699	\$2,999							
90 MB – 18 ms ESDI	\$3,499	\$3,799							
150 MB – 18 ms ESDI	\$3,999	\$4,299							
322 MB – 18 ms ESDI	\$5,999	\$6,299							



# A Full Line Of Computers With A Full Line Of Configurations.

At Dell, we understand that different users have different needs. So we tailor each system to the user's individual requirements.

We offer monitors, graphics boards, tape backups, dot matrix and laser printers, hard disk and diskette drives, expanded memory boards, serial mice and more.

We also offer third party software applications for virtually

every business application including: accounting, communications, desktop publishing, graphics, word processing, integrated applications and user training.

So when your Dell System arrives, you can do productive work the minute you unpack the box.

We can build you the system you've been looking for.

# COMMON TO THE SYSTEM 310, SYSTEM 220 AND SYSTEM 200:

The Dell System Analyzer. Guaranteed hardware and software compatibility. Security lock with locking chassis. 12 month on-site service contract (Available on complete systems).

**PRINTERS/SOFTWARE.** We offer a full line of printers and popular software. All printers come with our 30-day money-back guarantee.

# LASER PRINTERS.

LASER SYSTEM 150; \$5,995. 15 pages per minute, text and full-page graphics. Dual 250 sheet-input trays.

LASER SYSTEM 80; \$3,295. 8 pages per minute, text and full-page graphics.

LASER SYSTEM 60; \$2,195. 6 pages per minute, text and full-page graphics.

# DOT MATRIX PRINTERS.

PRINTER SYSTEM 800; \$699.95.

Highest resolution text and graphics from a 24-wire dot matrix printer.

Draft quality at 200 cps. Correspondence quality at 132 cps.

Letter quality at 66 cps. Standard parallel and serial interfaces.

Wide carriage.

PRINTER SYSTEM 600; \$499.95.

9-wire dot matrix.
Draft quality at 240 cps.
Near-letter quality at 60 cps.
Standard parallel interface.
Wide carriage.

PRINTER SYSTEM 300; \$199.95. 9-wire dot matrix.

Draft quality at 144 cps. Near-letter quality at 36 cps. Four standard fonts.

Paper parking.

Standard parallel interface.

# **OPERATING SYSTEMS.**

Dell Enhanced MS-DOS 3.3 with disk cache and other utilities; \$119.95. Dell Enhanced MS OS/2 Standard Edition 1.0 \$324.95.



# TO ORDER, CALL 800.426.5150 IN THE U.S. AND CANADA

All prices and specifications are subject to change without notice. Please inquire for current details. Dell cannot be responsible for errors in typography or photography. In Canada, leasing is not currently available and configurations and prices may vary. Microsoft, MS® and MS-DOS® are owned by Microsoft Corp. †Signifies registered or unregistered trademarks owned by entities other than Dell Computer Corporation. \*Available January 1, 1989. \*\*Payments based on a 36-month open-end lease. Please inquire for further details. © 1988 DELL COMPUTER CORPORATION.



# 80386s for the Masses

Twenty 80386-based clones that offer a revolutionary new feature—affordability

Steve Apiki and Stanford Diehl

ntel's introduction of the 80386 chip in 1986 set the DOS world on its ear. It ushered in a new age, where multitasking, greater memory access, and ever-increasing processing speed blurred the distinction between mainframes and microcomputers. This chip put dazzling power at the fingertips of every user willing to shell out \$5000 to \$15,000 for a Compaq Deskpro 386 or an IBM PS/2 Model 80.

Over the last year, however, the 80386 system market has grown from these elite few to look much more like the market for IBM PC AT clones, with offshore vendors assembling systems and sparing every expense. Most of these new entrants are the same ones who have been selling AT clones for years, and many of them offer fantastic savings.

Don't let these unfamiliar names and logos fool you: These are real 80386s, capable (with enough memory) of running OS/2 or Windows/386, and of reaching more memory than an AT ever dreamed of. They can be hooked up to networks and configured as multiuser systems or used as Unix workstations. Bargain systems they may be, but even at these bare-bones prices, an 80386 machine is hardly a commodity item. Every system deserves close inspection, something not easy to do when dealing with a mail-order house.

For this month's Product Focus, we



chose a group of systems selling in usable configurations for under \$3000 (see table 1). Our minimum requirement was that they include a clock speed of at least 16 MHz, 1 megabyte of memory, a 40-megabyte hard disk drive, a 1.2-megabyte floppy disk drive, a hard disk drive and floppy disk drive controller, a monochrome graphics card and monitor, a 101-key keyboard, a power supply, and both serial and parallel ports. In other words, the systems we tested had to be fully equipped.

What surprised us was not only the sheer number of systems meeting this requirement, but also the many optional features available. Some companies were able to throw in an extra megabyte of memory, for example, or upgrade from the usual 16-MHz system to 20 MHz. Of course, almost all the manufacturers offer upgrades of these base systems, if high performance is a must (see the text box "Upgrading from Entry Level" on page 168).

None of these machines are built around Intel's 80386SX, which is expected to unleash a flood of low-cost systems later this year. The 80386SX is a midrange processor, offering 32-bit capability, but with a slower 16-bit data bus. These review systems are true 32-bit systems, inside and out, and they rely on mass production and low-cost compo-



Photo 1: Two affordable 80386 machines that perform remarkably well—the Micro Express ME 386 (left) and the Gateway 386 (right).

nents to cut costs. All were evaluated using the new 80386 versions of our standard system benchmarks (see the text box "80386 Benchmarks" on page 172).

# **Heart and Soul**

When we sat down and started using these systems, we got used to seeing many of the same things: the same beige AT case, the same amber monochrome display, the same keyboard, and even the same motherboard. Most of these machines are assembled by resellers who simply take the components and put them in a box. The result is a hodgepodge of drives, power supplies, and system boards, where the only way to differentiate the systems is to take note of their choice of subsystems.

In such an environment, the best barometer of performance is the motherboard itself—the heart and soul of the machine-which simply becomes another component. Manufacturers can and do, however, make modifications to the same motherboard that can result in dramatic performance differences. They can adjust the memory speed and amount or change the clock frequency. What's more, some of these resold motherboard designs are clearly superior to others.

Unlocking the power of the 80386 requires complex memory interfacing. Its 32 data lines require 32-bit memory and a 32-bit path to reach it; its 32 address lines can theoretically access 4 gigabytes, but DOS limits program space to 640K bytes. Taken together, these factors impose restrictions on both the system designer and the user.

All these systems have 32-bit data paths on the system board, but you can fit only so much memory in the limited physical space. The only place to add more memory becomes the expansion slot, where you don't always get the full data path. Three of the systems-the Pacesetter 386, the Uniq 386, and the GCH EasyData 386—rely on stuffing the board with single in-line memory modules (SIMMs) to conserve real estate. Others—like the six units that share the Micronics 08-002-201 motherboard—do away with on-board memory entirely and simply have expansion cards on 32-bit slots.

The rest feature conventional memory on-board and an option for expansion using memory cards. Only 13 of the 20 systems tested, however, feature 32-bit expansion slots (see table 2); for the rest, you must fall back on 16-bit memory.

Going to a 16-bit slot halves the performance of the 80386, because it is forced to get the first word and then the second rather than making the 32-bit fetch it's capable of. At that point, your high-priced 80386 is acting like an 8086. Other memory performance hits occur when a CPU makes sequential access to the same memory bank. While the Micronics-based systems and a few others employ static RAM (SRAM), most systems make use of bank-switched dynamic RAM, where the CPU accesses one bank while the other bank of DRAM is refreshed. If a read or write operation

**Table 1:** For less than \$3000, all these systems offer at least a 16-MHz CPU and 1 megabyte of RAM, with a variety of memory configurations and expansion options ( $\bullet = yes$ ;  $\bigcirc = no$ ).

Computer	Price					CP	U					Motherboard
		Speed	Waits	4.77	<b>Sp</b> 6	eed s	selec 10	<b>t (MF</b> 12	<b>iz)</b> 16	20	FPU slot	
Blackship 386	\$2813	16 MHz	0	•	•	•	0	0	•	0	287	Micronics 08-002-201/B
Bus 386	\$2800	16 MHz	0		•		0	0		0	287	Micronics 08-002-201/B
Club 386	\$2724	16 MHz	0/1	0	0	•	0	0		0	287	Everex EV-3000A
CompuAdd Standard-386	\$2705	16 MHz	0				0	0		0	287	FS-101
DataWorld 386	\$2744	16 MHz	0				0	0		0	287	Micronics 08-002-201/B
Fortron 386	\$3000	20 MHz	0	0	0	0		0	0		287	Cache Comp 386-1001-002
Gateway 386	\$2995	20 MHz	0	0	•	•		•	0		287/387	Gene 386
GCH EasyData 386	\$2994	16 MHz	0/1	0	0		0	0		0	287/387	GCH PCB-386-AT-16
Hertz 386	\$2995	16 MHz	1	0	0	•	0	0	•	0	387	Intel iSBC 386-AT
Micro Express ME 386	\$2954	20 MHz	0/1	0	0		0	0	0		287	AMI-386
Micro 1 Power 386/20	\$2995	20 MHz	0	•	•		0	0	0		387	Micronics 08-011-201
PC Network THE PC 386	\$2854	16 MHz	0				0	0		0	287	Micronics 08-002-201/A
Pacesetter 386	\$2995	20 MHz	0/1	0	0		•	0	0		287/387	CompuSystems ver 1.0
Spear Mono-386A	\$2500	16 MHz	0/1	0	0	•	0	0		0	287	Everex EV-3000A
Suntronics-386	\$2785	16 MHz	0	•		•	0	0		0	287	Micronics 08-002-201/A
Uniq 386	\$2675	16 MHz	0	0	0		0	0		0	287	2M 810-04
Value 386	\$2831	16 MHz	0	•	•	•	0	0		0	287	Micronics 08-002-201/B
VIPC Micro 386	\$2999	20 MHz	0/1	0	0		0	0	0		287/387	AMR Micro 386
Whole Earth 386	\$2995	16 MHz	0/1	0		0	0	0		0	287	AMI/Mylex 386
Zeos 386 Tower	\$2995	16 MHz	0/1	0		0	0	0		0	287	AMI-386

<sup>&</sup>lt;sup>1</sup> Memory-access times may vary with machine purchase

<sup>3</sup> S = static; D = dynamic.

is attempted twice consecutively on the same bank, a delay is imposed on these systems. This performance problem lies in wait for any DRAM-based system; only faster RAM can help.

One system feature that can do wonders for processing speed is a memory cache. Six of these systems use a RAM cache to boost their processing power: the Micro Express ME 386, the Zeos 386 Tower, and the Whole Earth 386, with the AMI motherboard; Spear's Mono-386-A and the Club 386, with motherboards much like the AMI; and the Micro 1 Power 386/20. The cache is, in all but one case, 64K bytes of 32-bit SRAM, with short access times (40 to 45 nanoseconds). The Micro 1 features a 32K-byte RAM cache. The power of this feature was demonstrated in our benchmarks (see the graphs on page 173), where the top finisher overall and the top finisher in the 16-MHz group both had memory caches.

Most of these systems use the 384K bytes of RAM between 640K bytes and 1 megabyte—which DOS can't directly address—to relocate BIOS or video BIOS from slow ROM (sometimes referred to as shadow RAM). This feature did not

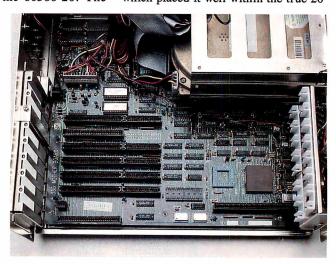
make a significant difference on our benchmarks, but software that makes frequent BIOS calls should see significant improvement.

Raw CPU and memory speed are, of course, important factors that can't be overlooked. All these systems use the 80386 double sigma, the standard chip with 32-bit address and data lines. While six systems run a 20-MHz clock, only four actually use the 80386-20. The

other two, the Gateway 386 and the VIPC Micro 386, use the same 80386-16 as every other system and simply run it at higher than its rated speed. Both machines turned in good benchmark performances, but constantly running any piece of equipment out of spec is a risky proposition at best.

Gateway added to the performance of its machine by including 60-ns RAM, which placed it well within the true 20-

Photo 2: Inside the Gateway 386: a 20-MHz clock, dual 80287/80387 support, and a 32-bit expansion slot provide power and room for growth.



<sup>&</sup>lt;sup>2</sup> Requires motherboard modification; otherwise, 1 megabyte.

			RAM			ROM BIOS	Runs OS/2 as configured	Power supply
On-board memory	Type <sup>3</sup>	Access time	Extended memory	Max. 32-bit memory	Cache		uo oomigai ou	oupp.)
1 M	S	80 ns	0	10 M	None	Phoenix 386 BIOS 1.10.B2	0	220 W
1 M	S	80 ns	0	10 M	None	Phoenix 3.07	0	200 W
1 M	D	120 ns1	0	4 M <sup>2</sup>	64K	AMI 386 BIOS	0	192 W
1 M	S	100 ns	0	10 M	None	Phoenix 386 BIOS 1.10.B1	0	200 W
1 M	S	80 ns1	0	10 M	None	Phoenix 386 BIOS 1.10.B2	0	230 W
1 M	S	80 ns	0	10 M	None	Award 386 BIOS c3.03	0	200 W
1 M	D	60 ns	0	12 M	None	Award 386 BIOS c3.03	0	200 W
2 M	D	100 ns	1 M	16 M	None	Phoenix 1.00 03	•	200 W
2.5 M	D	120 ns	2 M	16 M	None	Phoenix 386 BIOS 1.00.00	•	220 W
1 M	D	100 ns	0	4 M <sup>2</sup>	64K	AMI 386 BIOS	0	220 W
1 M	S	80 ns	0	10 M	32K	Phoenix 386 BIOS 1.10.B2	0	200 W
1 M	S	80 ns	0	16 M	None	Phoenix 386 BIOS 1.10.B2	0	200 W
1 M	D	100 ns	0	8 M	None	Phoenix 386 BIOS 1.01.02	0	200 W
1 M	D	80 ns	0	4 M <sup>2</sup>	64K	AMI 386 BIOS	0	200 W
1 M	S	80 ns	0	10 M	None	Award 386 BIOS c3.03	0	200 W
1 M	D	120 ns	0	8 M	None	AMI 386 BIOS	0	200 W
1 M	S	80 ns	0	10 M	None	Phoenix 386 BIOS 1.10.B2	0	220 W
2 M	D	100 ns	1 M	10 M	None	Quadtel BIOS	•	200 W
1 M	D	120 ns	0	4 M <sup>2</sup>	64K	AMI 386 BIOS	0	200 W
1 M	D	120 ns	0	4 M <sup>2</sup>	64K	AMI 386 BIOS	0	200 W

MHz category on our index. While memory speed played a role in all machines' success on our tests, the effect was outweighed by caching and clock speed more often than not.

Each reviewed machine has provisions for changing the CPU clock speed. Most are constantly running at a bus speed of 8 MHz to maintain compatibility with other devices. Several have multiple crystals on-board and are able to switch

to four different speeds.

You should consider more than speed when evaluating a motherboard. A key point is expandability—though 32-bit slots are important for memory expansion, 8-bit and 16-bit slots are just as vital for everyday cards like disk drive controllers and graphics adapters. The systems all have between four and six 16-bit expansion slots. On-board memory capacity must also be considered, because

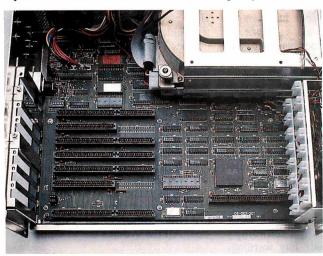
Photo 3: The popular Micronics 08-002-201 motherboard found in 6 of the 20 review machines (the Blackship 386 is shown here).

the price of a chip set is far less than the price of an expansion card. All machines also include battery-backed clock chips.

While the AMI motherboard mentioned earlier may well be the fastest, the most unusual is easily the AMR Micro 386 on the VIPC Micro 386. The VIPC, a proprietary design, includes everything but the disk drive controller on the motherboard, leaving all but one 16-bit slot available for future expansion. A serial port, a parallel port, and EGA circuitry are built in. This saves a considerable amount of money when configuring an EGA system, but you wind up paying for EGA even if you don't need it. The VIPC suffered on our benchmarks because monochrome EGA is several times slower than Hercules graphics.

# The Difference a Drive Makes

As July's roundup of hard disk drives pointed out, only system clock speed affects your computer's performance more than drive access times. A slow disk drive can seriously thwart the impressive processing speed of the 80386 chip. You cannot simply drop the chip into a system and expect breathtaking performance.



# Upgrading from Entry Level

J ust because you've decided on an entry-level 80386 system doesn't mean you have to live with it forever. Choosing a versatile system initially can lead to a wealth of performance-enhancing options down the road. As with any computer purchase, the number one criterion in selecting an upgrade path must be its utility in performing your primary application.

The best upgrade for calculation-intensive applications is a floating-point unit. An 80287 or 80387 can, in some cases, double your processing speed. We ran the 16-MHz Compaq Deskpro 386 through our benchmarks—with and without an 80287—and the difference was striking: a score of 10.38 on our application index versus 8.81, and that's taking into account applications that don't access the FPU at all.

There is also a marked difference between running an 80287 and running an 80387. Not only does the 80387 allow for direct 32-bit communication with the 80386, but its special hardware-implemented transcendental functions let it calculate sines and exponentials with ease.

To test the effect of a fast 80387 on overall system speed, we ran the benchmark suite on a 20-MHz Deskpro 386/20. The results: 17.93 when including the coprocessor, and 14.25 when leaving it out. Again, the numbers factor in applications like word processing and databases, which perform the same with or without the FPU.

Coprocessors let you compile and run programs specifically made to take advantage of 8087 code. Most FORTRAN and C compilers include library routines for this purpose; the alternative, using emulator code, is not nearly as good as the real thing. As an example, consider the numbers earned by these machines on our Livermore Loops and LINPACK tests. All of them, using the test compiled with emulation routines, scored significantly lower than the 80287-equipped IBM PC AT. The AT scores 0.0237 million floating-point operations per second on the Livermore Loops and takes 1010.22 seconds to execute the LINPACK; compare these with the benchmark results on page 172.

Adding memory is another way to increase performance without wasting any of your initial investment. The real multitasking power of an 80386 can be put to use only if you have enough space to use it in. Adding memory above the 1-megabyte level will let you use OS/2, which requires 1.5 megabytes. Memory must be at the same speed throughout the system, and it must be added in full-bank increments.

Unlike the standard 8-bit PC slot and the standard 16-bit AT slot, there is no standard for 32-bit expansion boards. You will often need to purchase memory boards from the same source as your system board, and your ability to upgrade memory may be only as good as the longevity of your system's manufacturer. Dynamic RAMs are not cheap,

and more and more memory is not always the answer. If you plan to use your 80386 more as a fast AT than as a multitasking system, better upgrade choices are available.

One of the best choices is adding a faster hard disk drive. Drive-access time contributes to delays no matter what applications you run. There is a difference, however, between adding memory or a coprocessor and upgrading your drive: The upgrade makes your current hard disk drive obsolete. If you have additional drive bays, you can continue to use your old drive, of course, but chances are you won't use it often enough to justify its original cost.

Nevertheless, the drive will probably be the slowest subsystem on your 80386, and a natural target for replacement. When you choose to do so, you can choose those with new high-speed small-computer-system-interface or enhanced-small-device-interface controllers that can cut average seek times from 28 milliseconds to 10 ms. These will really accelerate the performance of your system, but be prepared to pay dearly for them.

Other upgrade options will, like additional memory, affect your capability more dramatically than they will affect your performance. Color graphics, for example, will let you use the speed and power of the 80386 for CAD applications. With a sufficiently versatile system, the possibilities for improvement are almost endless.

Vendors, in an effort to stake a claim in the inexpensive 80386 market, must cut corners wherever possible by weighing the trade-off between low price and lost performance. Nowhere is that delicate balance more critical than in the choosing of a hard disk drive. That's because vendors can save considerable money by installing a bargain drive, and they can fatally hobble their system in the process.

Four of the systems employ the Seagate ST251-1 40-megabyte hard disk drive (see table 2), and for good reason: The company and the drive enjoy an excellent reputation. The drive's price is one of the lowest on the market, and it's a solid, dependable product. Six others opted for the original ST251, a slower drive, and the move turned out to be particularly bad for the PC Network THE

PC 386, which finished last on our disk benchmarks.

Zeos, on the other hand, opted for the Seagate ST277R, and our benchmarks reveal that the choice was a good one. In addition to excellent performance, the ST277R delivers over 50 percent more storage space, packing in 64 megabytes of data. Despite a slow access time of 40 milliseconds, the ST277R achieves its performance boost by employing runlength-limited (RLL) encoding at 7.5 megabits per second. The ST251-1 uses the same ST412 interface as the ST277R, but it uses modified-frequency-modulation (MFM) encoding at 5.0 megabits per second. The original ST251 uses the old ST506 interface.

While Zeos made a good choice, other vendors did not. Uniq Technology should have heeded our July warning.

That month's Product Focus placed the Microscience HH-1050 at the bottom of the benchmark results. Unfortunately, Uniq placed that same drive into its system and paid the price of poor performance. Those vendors selecting the Seagate ST4053 (VIPC, Blackship, and Value) also suffered the consequences, as all three systems placed in the bottom half of our drive benchmarks and our overall rating. Micro Express went with the Priam V150, and that drive certainly did not hamper the system's top-of-the-heap performance.

Disk drive controllers also play an important role. Since these systems are best thought of as entry machines on which to build, the controller should conform to that philosophy by offering ready expansion. All the systems tested support two



# UNLOCK ITS FULL 386 POWER WITH SCO XENIX 386 - NOW!

Under DOS, the COMPAQ DESKPRO 386/20™ is a powerful single-tasking, single-user system that can run thousands of DOS applications. In 16-bit, 8086 mode.

One at a time.

When OS/2<sup>™</sup> software becomes available, this computer can become a multitasking, singleuser system running in 16-bit, 286 mode that can also single-task those DOS applications under OS/2.

One at a time.

With DOS or OS/2, it will support one user—for the cost of the entire system.

Under SCO™ XENIX® 386, however, the COMPAQ DESKPRO 386/20 becomes a powerful multitasking, multiuser system that can run thousands of proven XENIX applications. In full-tilt, 32-bit, 386 mode.

Many at a time.

Using SCO VP/ix,™ it can multitask all the same DOS applications under SCO XENIX.

Many at a time.

With SCO XENIX 386, this powerful computer can support multiuser configurations of 16, 32, or even more workstations with such blazing performance that individual users will believe they have the whole system to themselves—at an unbelievably low cost per user.

And the best news is that you can unlock the full power of the COMPAQ DESKPRO 386/20 today because you can get SCO XENIX 386—now!

SCO XENIX System V and the SCO XENIX family of software solutions is available for all industry-standard 8086-, 80286-, and 80386-based computers, and the IBM® Personal System/2\*\*
Models 50, 60, and 80.



(800) 626-UNIX (626-8649) (408) 425-7222 FAX: (408) 458-4227 TWX: 910-598-4510 sco sacz

uucp:...decvax!microsoft!sco!info

Circle 234 on Reader Service Card

Table 2: The systems use a wide variety of disk drives, which differ substantially in performance.

Computer	Controller	Floppy	Hard	disk	•	
			Туре	Access	Capacity	
Blackship 386	WDC WD1003-WA2	1.2 M	ST4053	28 ms	44 M	
Bus 386	LCS-6620TX	1.2 M	ST251	40 ms	42 M	
Club 386	Everex EV-332	1.2 M	Micropolis 1333A	28 ms	44 M	
CompuAdd Standard-386	WDC WD1003-WA2	1.2 M	MiniScribe 6053-II	25 ms	44 M	
DataWorld 386	WD-1006-WAH/WD-1002 FDC	1.2 M	ST251	40 ms	42 M	
Fortron 386	Ntl. Computer Ltd. NDC5425	1.2 M	ST251-1	28 ms	42 M	
Gateway 386	WD-1006-WAH/WD-1002 FDC	1.2/1.44 M	ST251-1	28 ms	42 M	
GCH EasyData 386	Data Technology 5280CRA	1.2 M	ST251	40 ms	42 M	
Hertz 386	WDC WD1003-WA2	1.2 M	Micropolis 1323A	28 ms	44 M	
Micro Express ME 386	Ntl. Computer Ltd. NDC5425	1.2 M	Priam V150	28 ms	44 M	
Micro 1 Power 386/20	WDC WD1003-WA2	1.2 M	Toshiba MK-134FA	25 ms	44 M	
PC Network THE PC 386	WDC WD1003-WA2	1.2 M	ST251	40 ms	42 M	
Pacesetter 386	WDC WD1003-WA2	1.2 M	ST251-1	28 ms	42 M	
Spear Mono-386A	Everex EV-332	1.2 M	ST251	40 ms	42 M	
Suntronics-386	WDC WA2-16	1.2 M	ST251	40 ms	42 M	
Uniq 386	WDC WD1003-WA2	1.2 M	Microscience HH-1050	28 ms	44 M	
Value 386	WDC WD1003-WA2	1.2 M	ST4053	28 ms	44 M	
VIPC Micro 386	WDC WD1003-WA2	1.2 M	ST4053	28 ms	44 M	
Whole Earth 386	WDC WD1003-WA2	1.2 M	ST251-1	28 ms	42 M	
Zeos 386 Tower	Adaptec 2372	1.2 M	ST277R	40 ms	64 M	
<b>Software key:</b> a) Setup/diagn b) Disk utilities.	ostics c) Video utilities /disk management d) I/O utilities	,	nory management -DOS 3.30 w/GWBASIC			

hard disk drives and two floppy disk drives. Most vendors selected the Western Digital controller (WD1003-WA2) for the same reason that many selected the ST251-1 hard disk drive.

The Adaptec 2372 controller boosts the performance of RLL-encoded drives, but using MFM encoding lets you upgrade without buying a new controller.

National Computer Limited's NDC5425, the controller of choice in two of the three top performers, also proved a worthy product, delivering functionality, expandability, and 2-to-1 interleave.

DataWorld and Gateway reverted to a dedicated hard disk drive controller paired with a separate floppy disk drive controller. The 1-to-1 interleave of this combination enabled these two machines to finish second and third on our drive benchmarks, just behind the Adaptec 2372/ST277R-equipped Zeos.

# The Flesh and Bones

With so much emphasis being placed on the nitty-gritty system components— CPU, memory, and hard disk drive—the nuts-and-bolts features that bring it all together are often overlooked. Most users don't put much thought into the selection of things like monitors, keyboards, and cables. Sure, they are necessary, but as long as they perform the basic functions, you're covered.

e) 386 utilities

But think about that. The keyboard and the monitor are your direct interface with the computer. That's where the rubber hits the road. Though a blurry monitor or a defective keyboard might not affect basic system performance, it most certainly will affect your productivity, your enjoyment while working on the computer, and, in the long run, your overall evaluation of the product.

All the systems include monochrome graphics cards, except for the VIPC, which comes with an EGA on the motherboard. With the exception of the Bus 386's monochrome card, all the graphics cards also include an additional printer port. Each card supports 720- by 348-pixel resolution and packs a 64K-byte video buffer. The graphics cards in the Fortron 386 and the Gateway 386 performed the best in our video benchmarks.

The monitors also share the same basic specifications, although several vendors offer a 14-inch display rather than the standard 12-inch model. However, it was the shape of the screen, rather than the size, that made the biggest difference. The new flat display screens with square corners definitely presented a crisper image with less glare. While GCH, Hertz, CompuAdd, and Suntronics ship flat screens, we especially liked the EverVision 14-inch flat display atop the Club and Spear machines.

Like art and pizza combinations, the satisfactory feel of a computer keyboard is a matter of personal taste. In general, though, most people prefer a keyboard with positive tactile response and firm recoil. All these systems include either a 101-key or 102-key layout in the Enhanced IBM AT style.

The feel of the keyboards covered a wide range, from very subtle differences to basic design differences. The Blackship, Suntronics, and PC Network keyboards all lacked that comforting feel of positive tactile response: It's hard to tell when you've made true contact with the keys. Fortron's keyboard had miniature Control and Alt keys, and it also suffered from excessive recoil. On the other hand, the DataWorld, Hertz, Pacesetter, Value, Whole Earth, and Zeos key-

Vi	ideo		Ex	kpansion slo	ots		Software Included		
Board	Monitor	Size	8-bit	16-bit	32-bit	Printer	Serial	Game	
DTK	Quimax	14"	2	5	1	2	2	1	a,f
MGC	Panasonic	12"	2	5	1	1	1	1	a,d
Everex	EverVision	14"	2	6	0	1	1	0	b,c,d
MG-150	Samsung	12"	2	5	1	1	0	0	a,c
Graphicsmith MGP	Samsung	12"	2	5	1	2	1	1	a,f
MGP Monochrome	Samsung	12"	2	5	1	2	2	0	a,b,f
TOP MGP	Samsung	12"	2	5	1	2	2	1	a,f,g
MGP Adaptor	X-TRON	14"	2	5	1	2	1	0	a,b
Everex	Hertz	14"	2	4	2	2	1	0	a
Turbo MGP	VM-1400	14"	2	6	0	2	1	0	а
MG-132	Samsung	12"	2	5	1	2	1	1	a,b,c,d,f
6046 MGP	Samsung	12"	2	5	1	2	2	1	a,b,f
Twinhead	Packard Bell	12"	2	6	0	2	1	0	a,e
Everex	EverVision	14"	2	6	0	2	1	0	a,b,c,d,g
MGP	Mitsuba	14"	2	5	1	2	1	1	а
MG-150	Samsung	12"	4	4	0	2	1	1	a,c
Hercules	Samsung	12"	2	5	1	2	1	1	b,e,f
Motherboard	Quimax	14"	1	6	1	2	2	0	a,c
C&F Herc Comp	Packard Bell	12"	2	6	0	1	1	0	b,c
CT-6040T	Packard Bell	12"	2	6	0	2	1	1	b,c

boards all had the IBM-like true-click feel.

Almost all these systems use cables with a basic design flaw: They're just too darn short. This problem rears up most flagrantly with the Zeos system because of its "tower" configuration. This setup lets you free desk space by placing the unit on the floor beneath you, but the cables were so short that we still had to put the Zeos on the table with its monitor and keyboard. Kind of defeats the purpose of the "tower" design, doesn't it? CompuAdd's Standard-386 commits a worse oversight by omitting a COM1 port. You can expect an immediate upgrade if you go with this unit.

Another oft-overlooked item is documentation, and with these systems, clear documentation is not a given. Most of the vendors simply ship the manuals provided by the component manufacturers. This includes the woefully inadequate hard disk drive installation manual for those systems packing Seagate drives. We found confusing jumper settings on the Gateway machine, and the motherboard documentation did little to help. The motherboard manual shipped with the Uniq system was so poorly written that it was often incoherent.

In fact, a lack of clear and useful documentation plagued all these systems, although the Spear Operations Manual and the Club User's Manual were more comprehensive than most, and the Pacesetter's Technical Reference Guide displayed impressive depth.

# The Price of Paying Less

While these systems offer attractive price breaks, most of the companies are unknown quantities in the 80386 market. Most haven't yet built a strong track record. If you end up spending saved money on repair bills, enhancements, or perhaps even another computer before the expected life has expired, you end up losing in the long run.

Major vendors, on the other hand, usually have a proven track record. Good or bad, that track record is something to go on. It's often a key to such factors as durability, reliability, and customer satisfaction. These vendors usually have established a network of customer support that few minor vendors can match. Though the minor vendors often have a technical-support department, staffing is usually inadequate.

Remember, also, that these vendors had to cut costs somewhere. Just make sure you know where the cuts were made and what the trade-offs are. For example, a couple of the vendors, Gateway and VIPC, shipped 20-MHz crystals with 16-MHz chips. The chips will run at 20 MHz, but the manufacturer will not guarantee performance at that rate. So it's a gamble. You have to decide if that kind of risk is worth taking.

Given the piecemeal structure of these systems and their low price, you'd expect to run into a few problems now and again. We expected to run into a few during this review, but it went far beyond our expectations. Fully 6 of these 20 machines had problems when we first received them, problems that ranged from nuisances to complete system failures. And these are demonstration units, which should be the cream of the crop.

Problems included BIOS fatal errors, erratic disk failures, a nonfunctioning serial card, and the especially annoying keyboard with the T key not working. Some systems were shipped with mechanical problems, like a full-height disk drive jammed into a drive bay at a 45 de-

						В	YTE Bei	nchmai	rk Inde	xes					
Computer	Conventional benchmark results			L	ow-lev	el	Application-level								
	LINPACK	Lvrmore	Dhry	CPU	Disk	Video	Wp	Sprd	Db	Sci/ eng	Complr	Cum			
Micro Express ME 386	1698.51	0.0125	5952	3.30	1.47	2.58	3.46	2.73	1.73	1.31	2.32	11.54			
Gateway 386	2000.61	0.0107	5149	2.77	1.55	2.80	3.16	2.25	2.39	1.14	2.27	11.2			
Fortron 386	2001.60	0.0102	5086	2.77	1.33	2.84	3.15	2.78	1.54	1.12	2.15	10.74			
Zeos 386 Tower	2140.23	0.0094	4098	2.61	1.97	2.25	3.08	2.67	1.54	1.05	2.30	10.6			
DataWorld 386	2513.00	0.0081	4061	2.20	1.52	1.64	2.76	2.34	2.15	0.90	2.14	10.29			
Spear Mono-386A	2141.21	0.0095	4724	2.61	1.38	2.28	3.01	2.66	1.45	1.05	1.92	10.0			
Micro 1 Power 386/20	2366.35	0.0087	4336	2.54	1.44	1.86	2.90	2.39	1.69	0.98	2.07	10.0			
Club 386	2141.21	0.0099	4716	2.62	1.39	2.28	2.91	2.17	1.56	1.05	2.06	9.7			
Whole Earth 386	2140.17	0.0099	4743	2.75	1.30	2.25	2.92	2.16	1.50	1.05	2.05	9.6			
VIPC Micro 386	2118.10	0.0100	4766	2.91	1.33	1.90	2.72	2.46	1.54	1.07	1.90	9.6			
CompuAdd Standard-386	2513.00	0.0081	4065	2.20	1.43	1.66	2.64	2.34	1.50	0.88	1.91	9.2			
Pacesetter 386	2211.96	0.0097	4081	2.36	1.43	2.06	2.60	2.15	1.48	0.97	1.88	9.0			
Suntronics-386	2514.00	0.0081	4065	2.20	1.23	2.33	2.62	2.15	1.44	0.90	1.83	8.9			
Blackship 386	2519.38	0.0085	4045	2.43	1.33	1.48	2.74	2.01	1.43	0.89	1.81	8.8			
Bus 386	2513.33	0.0081	4065	2.20	1.04	1.63	2.57	2.14	1.51	0.89	1.70	8.8			
Value 386	2513.34	0.0085	4065	2.20	1.22	1.65	2.66	2.00	1.32	0.90	1.85	8.7			
GCH EasyData 386	2569.08	0.0083	4065	2.42	1.34	1.84	2.45	2.00	1.50	0.90	1.90	8.7			
PC Network THE PC 386	2513.00	0.0085	4065	2.20	0.93	1.63	2.54	1.97	1.43	0.91	1.83	8.6			
Uniq 386	2544.00	0.0074	4115	1.87	1.26	1.50	2.47	1.91	1.45	0.82	1.78	8.4			
Hertz 386	2898.97	0.0075	3396	2.03	1.32	1.57	2.09	1.61	1.32	0.82	1.75	7.5			

# 80386 Benchmarks

# Rick Grehan

PYTE is taking this opportunity—the first roundup of affordable 80386 systems-to introduce our 80386-specific low-level benchmarks. I've modified the code-generation portion of BYTE Small-C for MS-DOS to emit 80386 code compatible with Phar Lap's 386 ASM, 386 LINK, and RUN386 combo package. The most important addition? It's 32-bit integers, of course. As you peruse the benchmark results, be aware that the Sieve, Sort, and Matrix programs, calculated into the CPU indexes, are now manipulating 32-bit integers, pointers, adds, subtracts, multiplies, and divides, and an addressing capability that cracks the 64K-byte barrier.

Indexes show relative performance; for all indexes, an 8-MHz IBM PC AT=1.

All low-level benchmarks were generated using the 80386 version (1.1) of Small-C (32-bit integers). For the Livermore Loops and Dhrystone tests only, higher numbers mean faster performance. For a full description of all the benchmarks, see "Introducing the New BYTE Benchmarks," June BYTE

We're also generating two additional figures with the String Move benchmark: doubleword-odd and doublewordeven. Recall that String Move clocks

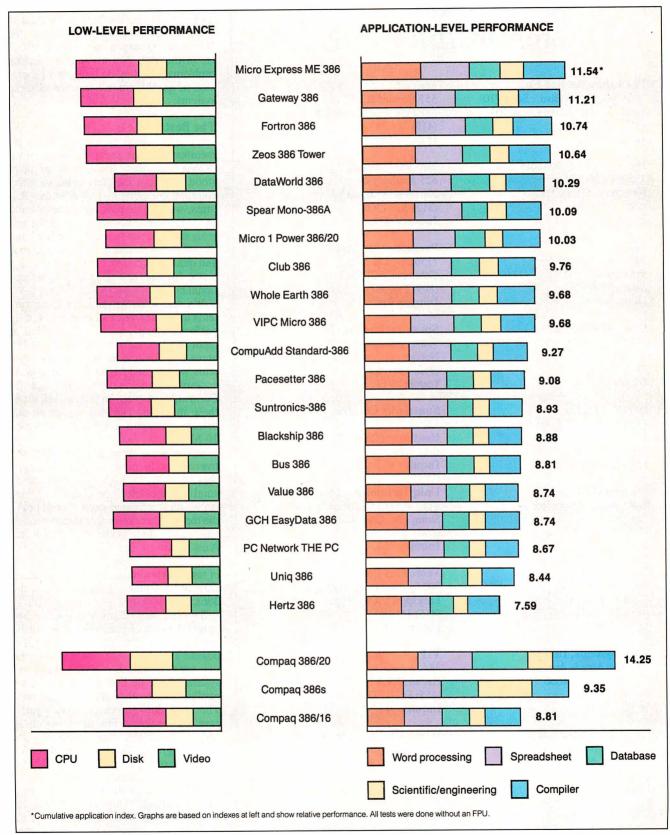
the time required to move blocks of data from one memory location to another, and that it moves the bytes one at a time (byte-wide) and two at a time (wordwide). The new version reports the additional figure for 4 bytes at a time (doubleword-wide). Also, depending on the processor's data bus width and the system's memory hardware, moving a word from odd address to odd address can turn in a significantly different time (usually a worse result) than moving a word from even address to even address. The same holds true for doubleword moves.

Though none of these systems include a floating-point unit, I've modified the floating-point coprocessor librarywhich originally assumed only an 8087 coprocessor-to take advantage of new instructions within the 80387. (We've also developed an 80287 library that

we'll bring on-line soon.) You'll see the most noteworthy performance boosts in the benchmarks involving transcendental functions. Specifically, the 80387 has a single instruction for calculating the sine (on the 8087, you had to derive the sine from the tangent), and calculating the exponent requires fewer instructions than for the 8087 and the 80287.

We'll be using the 80386 version of the benchmarks for all upcoming 80386 machines. As usual, we'll be making the source code for the 80386 version of Small-C and the updated benchmark programs available in the public domain (see page 3 for details). If you have any suggestions or comments, we'd like to hear them.

Rick Grehan is a BYTE senior technical editor at large. He can be reached on BIX as "rick\_g."



**Figure 1:** The Micro Express ME 386 and the Gateway 386, with 20-MHz 80386s, finished tops. Of systems with 16-MHz 80386s, the Zeos 386 Tower and the DataWorld 386 are on top. Fourteen systems finished higher on the benchmarks than a 16-MHz Compaq Deskpro. Compared to the Compaq 386s, all had a higher CPU index, and half had a higher application index.

# **Company Information**

Blackship Trading Co. 385 Oyster Point Blvd., Suite #10 South San Francisco, CA 94080 (415) 952-1994 Inquiry 898.

Bus Computer Systems 135 West 26th St. New York, NY 10001 (212) 627-4485 Inquiry 899.

Club AT, Inc. 3401 West Warren Ave. Fremont, CA 94589 (415) 683-6600 Inquiry 900.

CompuAdd Corp. 12303-G Technology Blvd. Austin, TX 78727 (800) 627-1967 Inquiry 901.

DataWorld, Inc. 3733 San Gabriel River Pkwy. Pico Rivera, CA 90660 (213) 695-3777 Inquiry 902.

Fortron Corp. 2380 Qume Dr., Suite F San Jose, CA 95131 (408) 432-1191 Inquiry 903.

Gateway 2000 P.O. Box 2414 Sioux City, IA 51107 (800) 233-8472 Inquiry 904.

GCH Systems, Inc. 845 West Maude Ave. Sunnyvale, CA 94086 (408) 733-2131 Inquiry 905.

Hertz Computer Corp. 325 Fifth Ave. New York, NY 10016 (212) 684-4141 Inquiry 906.

Micro Express 2114 South Grand Ave. Santa Ana, CA 92705 (714) 662-1973 Inquiry 907. Micro 1 557 Howard St. San Francisco, CA 94105 (415) 974-5439 Inquiry 908.

New PC Network 625 Academy Dr. Northbrook, IL 60062 (312) 205-1300 Inquiry 909.

Pacesetter Systems 7130 Fire Lane Rd. Columbia, SC 29233 (803) 736-0673 Inquiry 910.

Spear Technology, Inc. 710A Landwehr Rd. Northbrook, IL 60062 (312) 480-7300 Inquiry 911.

Suntronics Co., Inc. 12603 Crenshaw Blvd. Hawthorne, CA 90250 (213) 644-1140 Inquiry 912.

Uniq Technology, Inc. 1120 Stewart Ct., Suite G Sunnyvale, CA 94086 (408) 736-7440 Inquiry 913.

Value Plus Distributing 900 Larkspur Landing Cir., #165 Larkspur, CA 94939 (415) 461-0811 Inquiry 914.

VIPC Computers 384 Jackson St., Suite #1 Hayward, CA 94544 (415) 881-1772 Inquiry 915.

Whole Earth Electronics 2990 Seventh St. Berkeley, CA 94608 (415) 653-7758 Inquiry 916.

Zeos International 530 Fifth Ave. NW, Suite 1000 St. Paul, MN 55112 (612) 633-4591 Inquiry 917. gree angle, or motherboards installed so close to the edge of the case that the flange on the expansion cards wouldn't fit in the slot. Not all terribly serious problems, but they do indicate a general lack of quality control in some of these systems.

# The Best for Less

Looking at these systems made us remember the true meaning of the word "clone." At first look, none of them stood out from the rest. With so many common components and identical features, we thought picking the best would be impossible. Luckily, a few of the systems shucked the "cheap" label and displayed an admirable mix of performance and quality. A couple of the systems went a step further, emerging as truly exceptional buys.

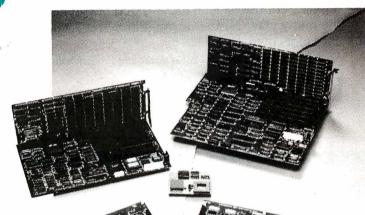
It's one thing to compare these systems to one another and find outstanding performance; it's quite another to look at them in reference to the rest of the 80386 arena and find the same thing. The systems we've rated highly here give good account of themselves, even against Compaq's big guns. In fact, all but six of these machines finished higher on our benchmarks than a similarly equipped 16-MHz Deskpro.

While none were able to touch the overall performance of the Deskpro 386/20—with its high-speed enhanced-small-device-interface disk drive controller and dedicated cache controller—the top finishers were able to come much closer than their prices would indicate. And what of the 386s, Compaq's 80386SX-based machine? Every last one of these review machines earned a better CPU index than the 1.86 assigned to the 386s.

Superior subsystems also became apparent. Our benchmarks demonstrate the superiority of the AMI-type motherboard: The three AMI systems and the two very similar EV-3000A-equipped systems made up half of the top 10, regardless of the other system parameters. The AMI does, however, have significant drawbacks: A low memory ceiling and a lack of 80387 support will hamper future upgrades. On the other side of the coin, the common Micronics 08-002-201 motherboard was installed in systems accounting for 6 of the bottom 10. For a full accounting of the performance indexes, see page 173.

Often, the choice in memories comes down to a trade-off between size and speed. The Hertz 386, though very slow, does come with 2.5 megabytes of mem-

# Insist On The Best Micronics Motherboards





high speed **CACHE** memory.

Micronics is the leading supplier to **OEMs**, **VARs** and Systems Integrators that require the **best in 80386 technology**.

For a distributor near you, call **800 / 234-4386.** 

Innovation and Performance

MICRONICS

COMPUTERS INC.

© Copyright 1988 Micronics Computers, Inc.

**80386 CLONES** 

# WHY TRUST OUTSIDERS WITH THE INSIDE **OF YOUR NEC COMP**



high quality parts, and comprehensive maintenance contracts. Call us, and find out about the many ways NEC Information Systems takes care of its own.

Service Excellence Through People, Pride and Professionalism<sup>SM</sup>

1-800-325-5500



# **Computers For The Blind**

Talking computers give blind and visually impaired people access to electronic information. The question is how and how much?

The answers can be found in "The Second Beginner's Guide to Personal Computers for the Blind and Visually Impaired" published by the National Braille Press. This comprehensive book contains a Buyer's Guide to talking microcomputers and large print display processors. More importantly it includes reviews. written by blind users, of software that works with speech.

# Send orders to:

National Braille Press Inc., 88 St. Stephen Street Boston, MA 02115, (617) 266-6160

NBP is a nonprofit braille printing and publishing house.

ory. The Hertz was able to run memoryhungry OS/2 as configured, a trait shared only by the EasyData 386 and the VIPC Micro 386. Our test for OS/2 compatibility was a simple one, running three simultaneous processes from Microsoft's OS/2 demonstration disk. No times were recorded. We did have some video problems when running OS/2 on the VIPC, and we could not get it to run successfully using the on-board EGA. The company assured us that it had no problems running OS/2 on similar units, and we did get it to work using an external Hercules card.

All manufacturers claim Windows/ 386 compatibility. We were unable to test this, though, because Windows/386 version 2.0 does not include a Hercules driver, and version 2.1 was not shipping as of press time.

Beyond the raw benchmark results, we looked at many factors when evaluating these systems. We considered the apparent quality of the overall product, the performance of the subsystems, the general look and feel, and the reliability of operations. Even so, it is hard to ignore the impressive performance of the Micro Express ME 386 on our benchmarks. It not only excelled on our low-level tests, especially the CPU index, but it also blazed by the other machines when converting that low-level capability to practical applications. Churning along at 20 MHz, it posted an application index of 11.54, good enough for top honors.

However, when evaluating the whole package, the Gateway 386 surpasses all the others. Coming in a close second on our application index, the Gateway delivers speed without sacrificing features: a 16-MHz chip running at 20 MHz, 60-ns RAM, a 1.44-megabyte 3½-inch floppy disk drive to accompany the standard 1.2-megabyte 54-inch floppy disk drive, an extra serial port and a game port, DOS 3.30 with GWBASIC, and sockets for both the 80287 and the 80387 coprocessors. The system ran without a glitch, although we would prefer to see a true 20-MHz chip under the hood. We were truly surprised to see a system of this caliber selling for less than \$3000.

It's a testament to the state of the 80386 market. You don't have to wait for the unveiling of the 80486 or for prices to drop on the hybrid 80386SX to get an 80386 at a reasonable price. The shakeout has arrived. The clones are here. And they can get the job done. ■

Steve Apiki and Stanford Diehl are testing editors for the BYTE Lab. They can be reached on BIX as "apiki" and "sdiehl."



**EQUITY II PLUS** 

1.2 Meg Floppy40 Meg Hard Disk640K Ram

• Serial/Parallel/C/C • 80286 CPU

Graphic Card

**EPSON EQUITY is** 

· MS DOS

GW Basic

Monochrome Monitor

In order to provide the best service,

exclusively sold on location.

# 360K Floppy20 Meg Hard Disk

EQUITY I+

- 640K Ram
- Serial/Parallel Port Monochrome Card
- Monochrome Monitor
- GW Basic

\$1295

# **EQUITY III+**

- 80286 CPU 6-8 12 MHz
- 1.2 MEG Floppy
- 40 MEG Hard Disk
- DOS 3.2 Mono Monitor & Graphic Card

\$2195

# LOW PRICE LEADER

**SINCE 1983** 

# **Everex**

Step 286 - 12 & 16 MHz 1 Meg RAM Set up utility in ROM S/P, C/C Enhanced keyboard 1.2 MB floppy DOS/BASIC

\$Call for your configuration

# Everex

DOS/BASIC

Step 386-20 MHz & 16 MHz 256K cache of very high speed RAM 2 Meg RAM, expandable to 16 Meg S/P. C/C

Enhanced keyboard 1.2 MB floppy

\$Call

# COMPAQ

386 130 meg/20 MHz 6495	j
286 40 meg	j
386 40 meg/16 MHz4195	)
386 60 meg/20 MHz	!
Portable III 40 meg/12 MHz 4195 CARD & MONITOR EXTRA	,

# THE REAL PROPERTY AND ADDRESS OF THE PARTY ADDRESS OF THE PARTY AND ADDRESS OF THE PARTY ADDRESS OF THE PAR

PS/2	model	30/20	meg							·		1775
PS/2	model	50/20	meg									2595
PS/2	model	60/40	meg						÷			3395
PS/2	model	60/71	mea			1						4100
PS/2	model	80/40	meg									4595
		MONIT	OR E	X	T	R	A	١				

# LAP-TOP

Toshiba 3200-40	3695
Toshiba 3100-20	. Call
Toshiba 1000	. Call
NEC Multispeed	1395
NEC Multispeed EL	1595
EPSON LT	. Call

**WE STOCK** 

CITIZEN OKIDATA **EVEREX**  **TOSHIBA NEC WYSE** HITACHI

PRINCETON GRAPHICS SONY ACFR HOUSTON INSTRUMENTS

**AMDEK** HAYES SAMSUNG CALCOMP

PC MOUSE MICROSOFT MICE LOGITECH MITSUBISHI

**IRWIN & ARCHIVE** TAPE BACK TAXAN

# Macintosh

Mac-SE/20	Meg											2595
Mac-II/40	Meg.									•		3795

# **ARCHE RIVAL 386**

10/20 MHZ, 1	2	II	O	וכ	יַכ	١,	2	١	۷	E	5				
Monochrome			٠.												\$2995

# SOFTWARE

							-	•		_	٠.				_		
Microsoft Word																239	
Word Perfect 5.	0						•									249	
Lotus 1-2-3					٠	•	•			٠						29/	
dBase III +		,			^	NI	V	;	R		'n	D	_	٠	٠	300	
AND MA	M.	r,	ľ	11	H	IA	I		IV	ı	J	n					

# SPECIALS of the Month

Microsoft Mouse		.\$109
Microsoft Excel		.\$309
Aldus Pagemaker		.\$479

# AST

AST 386	model	340	2.20						4395
AST 286	model	80	•						1695
AST 286	model	120			•		•	•	Call
AST 286	model	140		 •			•	•	2605
	ARD &								2000

# **EPSON®** PRINTERS

Epson	FX850/1050 \$379/535
Epson	LQ850/1050 \$559/785
	LQ500/2500 <b>\$359/895</b>
Epson	LX800/EX800 \$199/445
	LQ2550 \$970

# CITIZEN

180D/15E <b>\$179/385</b>
MSP40/45 <b>\$299/439</b>
MSP50/55 \$399/509
Tribute 124/224 \$529/679
Overture Lazer \$1459
HP LASER Jet II .\$1750

WE ACCEPT LC, CASHIER CHECKS, MONEY ORDERS, VISA, MC, AMEX 3% charge on VISA, MC & 5% on American Express

# COMPUTER LANE

HOURS: M-S 9-6 1-800-526-3482 (Outside CA) (818) 884-8644 (In CA) (818) 884-8253 (FAX)

Prices subject to change without notice

22107 ROSCOE BLVD. CANOGA PARK 1/2 BLOCK W. OF TOPANGA CA 91304

Compaq is a Registered Trademark of Compaq IBM is a Registered Trademark of International Business Machines

CALL FOR VOLUME DISCOUNTS

CORPORATE ACCOUNTS WELCOME

CONSULTANTS CALL FOR PRICING

# SCSystems 1-800-669-9933

Serving Computer Buyers For Eight Years

Para Asistirle En Espanol Llame Al Tel 1-800-842-1777

# **PANASONIC** KXP1091I

Printer \$199

# **SAMSUNG**

12" Flat Amber Monitor

\$82

# LOGITECH

C7 Mouse W/Plus Software

\$68

# **HARDWARE**

# **ACCESSORIES**

opyHPC Bra	Deluxe \$	99
lasterpiece +		95

# COMPUTERS

# SCSystems Series 88 XT Computer

Slide Case Top w/upfront keylock, turbo button/led, reset button. 150 watt power supply, 360K drive, 477 10MHz, 640K. Phoenix Bios. AT style keyboard, Limited one year warranty.

# \$565

AST Premium/286	
Model 120	\$2279
Model 80	1629
Model 140X	2479

# **BOARDS**

AST Adv Prem 1mb \$	Call
AST 6Pac Prem 1mb	525
AST Sixpac	115
Hercules Grph +	182

# **EGA BOARDS**

ATI EGAWonder\$	175
Genoa SuperHiRes+	195
Orchid Designer	Call
Paradise 480	Call
Paradise VGA +XT	
Paradise VGA Prof	385
Vega VGA	269

# **EGA MONITORS**

Princeton U/Sync\$	529
NEC Multisyne 2	589
Samsung	359

## HADD DOWE

HAND DRIVES		
Seagate 12	25 w/cont\$	321
	88 w/cont	411
	MB w/cont	294
	MB w/cont	269

Logitech \$	68
MS Bus Mouse	99

# MODEMS

Hayes 1200\$	Call
Hayes 1200B	Call
Incomm RPC1200	62
Incomm RPC2400	147
Incomm T1200	76
Incomm T2400	
Incomm T2400EC	224

# MONITORS

Amdek 410\$	145
Princeton MAX15	Call
Samsung RGB	215
Samsung Amber	82

# 3COM

3C503	ELink II	\$345
3C523	ELink/MC	432

# **PRINTERS**

Citizen	
120D\$	Call
180D	199
MSP-15E	319
MSP-40	285
C.Itoh ProWriter C715	925
NEC P2200	Call
Okidata Call on all models.	
Panasonic	
1080I/M2	164
1091I/M2	100

# Star

NX-15	Cal
Toshiba	
321SL	500
341SL	
351SX	100

# **SOFTWARE**

# ACCOUNTING

DacEasy 3.0 \$	54
DacEasy Bonus 3.0	110
Dollars & Sense	95
Managing Your \$	117

COMMONIOATION	
Carbon Copy Plus\$	10
CrossTalk XVI	8
CrossTalk MK 4	11
PC Anywhere 3	9
SmartCom II	8

# DATABASE

DATABASE	
Clipper \$	Cal
Data Perfect	28
DBase III	
DBXL Diamond	10
Fox Base +	19
Paradox 2.0	43
Q and A	
Relate & Report	100
DECKTOR BURLIOUS	

# **DESKTOP PUBLISHERS**

V	Ventura	495
1	PFS First Pub. 2.0	70
T	Pagemaker 3.0\$	Vai

# GRAPHICS

Chartmaster \$	199
Generic Cad 3.0	5
Harvard Graphics	272
Printshop	3:
Signmaster	Cal

No Charge for Mastercard or Visa



# INTEGRATED

Ability :	Plus	 	 \$	139
First Ch	oice .	 	 	87

# LANGUAGES

MS QuickBasic \$	60
MS Quick C	60
Turbo Basic	59
Turbo C	59
Turbo Prolog 2.0	89

# **SPREADSHEETS**

Lotus 123\$	Call
Quattro	Call
Surpass	
VP Planner Plus	87

# UTILITIES

	_
CopyIIPC\$	18
Desqview	71
Duet	48
Fastback Plus	88
Formtool	52
Mace	48
Norton Advanced	72
Norton Commander 2.0	43
PC Tools Deluxe	36
Sidekick Plus	117
Sideways Print	. 39

# WORD PROCESSING

Rightwriter\$	49
Sprint	117
Word Perfect 5.0	219
Wordstar 2000	
XY III Plus	275
VISA	

# Call For Items Not Listed

# **SCSystems**

205 S. 29th St., Phoenix, AZ 85034

Order Line 800-669-9933 Status Line 602-275-1395

Espanol 800-842-1777 FAX No. 602-273-0043

Order Line for Europe & Mexico 602-275-1395

TERMS: No charge for Visa or Mastercard. We do not charge your card UNTIL WE SHIP your order. Manufacturers warranty applies in all cases, all warranties are handled by the manufacturers. We accept Purchase Orders from authorized companies only, for 3.5% above cash price. No COD orders. No refund on opened software. All prices are subject to change. Allow 14 days for personal/company checks. Arizona orders add 6.7% tax. Add 2% for shipping plus \$2.00 for handling (\$4.00 minimum). Please call for shipping charges on all Canada and International orders. We do not guarantee compatibility. All returns are subject to a 20% restocking fee.



# Bucking the System



Dell's System 310 proves that top-notch performance doesn't have to come at top-shelf prices

John Unger

aking a 20-MHz 80386-based microcomputer run at its maximum potential requires more than a 20-MHz CPU: The entire suite of hardware components has to interact efficiently. Such optimized performance was obviously a prime consideration when Dell's engineers designed the System 310.

The System 310 is a solid, high-performance 80386 computer that's a prime contender for the title of fastest 20-MHz 80386 machine. But that's not all; the machine's excellent performance comes at a price that's well below that of comparable systems.

The System 310 is available in a variety of models that share the same basic hardware. Each has a 20-MHz CPU, 1 megabyte of RAM, a 1.2-megabyte 5¼-inch floppy disk drive, and a VGA card. The entry-level model also includes a

VGA monochrome monitor and a 28-millisecond 40-megabyte hard disk drive for \$4099. My review unit included 2 megabytes of RAM, a 20-MHz 80387 coprocessor, a 1.44-megabyte 3½-inch floppy disk drive, a 90-megabyte enhanced-small-device-interface (ESDI) hard disk drive, and a high-resolution VGA color monitor. This brought the grand total for my system to \$7000.

# **Performance Credentials**

A Chips & Technologies 20-MHz 80386 chip set underlies the System 310's basic design. These components, integrated with a concurrent bus architecture and high-speed cache and main memory, form the framework of the Dell System 310. You can set the 20-MHz 80386 CPU to switch to 8 or 4.77 MHz when you press the Control, Alt, and backslash keys. The system's expansion bus runs independently of the CPU's clock speed at a consistent 8 MHz. The motherboard also has one 32-bit memory slot, six 16bit AT slots, two 8-bit PC slots, and a socket for a 20-MHz 80387 math coprocessor.

Memory access has been optimized in two ways. The system's concurrent bus architecture allows the system bus to be effectively decoupled from the processor bus. The CPU can then execute instructions while the system bus is running direct memory access (DMA) cycles, thereby speeding up operations such as disk and memory data transfers. The System 310 also incorporates an Intel 82385 cache memory controller and 32K bytes of high-speed, 35-nanosecond static RAM (SRAM), like the Compaq Deskpro 386/20, the ALR FlexCache 20386, and other high-performance 80386 machines.

The main purpose of the cache is to provide a fast access buffer of SRAM between the processor and the slower, normal dynamic RAM that makes up the computer's main memory. The cache

# **Dell System 310**

### Company

Dell Computer Corp. 9505 Arboretum Blvd. Austin, TX 78759 (800) 426-5150

# Components

Processor: 20-MHz 32-bit Intel 80386 with zero wait states, switchable to 8 or 4.77 MHz; socket for 20-MHz 80387 coprocessor

Memory: 1 megabyte of 80-ns RAM. expandable to 2 megabytes on system board (maximum system memory is 16 megabytes); Intel 82385 cache controller with 32K bytes of 35-ns SRAM; Phoenix 80386 ROM BIOS Plus, version 1.10 09 Mass storage: One 1.2-megabyte 51/4inch floppy disk drive; 40-megabyte ATtype or 90-, 150-, or 322-megabyte **ESDI** hard disk drive Display: Monochrome, EGA, VGA color, VGA Plus color, or VGA monochrome monitor Keyboard: 101-key IBM Enhanced-style keyboard I/O interfaces: Two RS-232C serial ports with DB-9 connectors; DB-25

61/4 x 211/8 x 171/2 inches; 45 pounds

expansion slot, six 16-bit slots, and two

parallel port; one 32-bit memory-

## Software

8-bit slots

Microsoft MS-DOS 3.30 and custom utilities; Microsoft GWBASIC 3.22; Microsoft Windows/386

# **Options**

1-megabyte SIMM upgrade: \$899.95 Dell memory-expansion board with 2 megabytes: \$1799.99 20-MHz 80387 math coprocessor: \$799.95

40-megabyte internal tape backup unit: \$399.95

1.44-megabyte 31/2-inch floppy disk drive: \$199.95

## Documentation

167-page System 310 Owner's Manual: 77-page MS-DOS 3.30 Enhancement Guide; 475-page MS-DOS 3.30 User's Reference; 425-page Microsoft GWBASIC Interpreter User's Reference

# **Price**

Base system (with one 1.2-megabyte 51/4-inch floppy disk drive, 40megabyte hard disk drive, and VGA monochrome display): \$4099 System with 322-megabyte ESDI hard disk drive and VGA Plus color display: \$7699

System as reviewed: \$7000

Inquiry 883.

controller holds what it thinks are the next 32K bytes of instructions and/or data the CPU needs and lets the CPU run with no wait states. The chip does more than simply control the high-speed SRAM cache, though. It also figures out when to load new data into the cache, and it determines which parts of RAM are mapped directly to the video display and shouldn't be put into the cache.

I don't want to give the impression that the System 310's main memory is slow; it's not. Dell uses 80-ns RAM chips on the motherboard, which has eight connectors for special single in-line memory modules (SIMMs) that each hold 256K bytes of RAM. (The system comes with 1 megabyte of RAM that takes up four of these slots.) You can also add memory to the system by mounting a Dell memory card fitted with 80-ns memory chips into a proprietary 32-bit expansion bus. Finally, you can use standard AT-type memory cards in the 16-bit expansion slots. If you decide to add RAM to the system by using the Dell bus, however, you won't have enough room to add a full-length expansion card in the 8-bit slot at the left-hand edge of the computer. The maximum configuration for system memory is 16 megabytes.

To make the most of the increased memory-access performance that the system's interleaved memory provides, you have to install an additional 1 megabyte of RAM on the system board. Also, if you install a proprietary 32-bit memory-expansion card, you must add another megabyte to the standard 1 megabyte to achieve the full benefits of interleaved memory. After adding 4 megabytes of RAM to the motherboard and the 32-bit bus, you can install an additional 12 megabytes of RAM by using Lotus/Intel/Microsoft Expanded Memory Specification memory cards in the 16-bit AT-compatible expansion slots.

You also have the option of copying the system BIOS from ROM to a special write-protected area of RAM located above the 640K-byte partition. The BIOS ROM and RAM have identical memory addresses. A similar option for the BIOS of an EGA or VGA speeds system and video display performance. You can make these options part of the system's setup program so that they take effect when you boot the system. This feature may be incompatible with future releases of DOS or OS/2, however, so Dell made it an option in the setup program.

Speaking of Speed

There's only one way to describe the performance of a microcomputer like the System 310: It flies. The machine has all the hardware and design potential to make it as fast as or faster than any other 20-MHz 80386 system that BYTE has tested. The Dell machine has a slight edge over the Compaq 386/20 in that it uses 80-ns RAM for its interleaved memory while the Compaq uses 100-ns chips, and the Dell can store the instructions from its operating-system BIOS and video ROM chips in RAM for faster access.

The System 310 outperforms the IBM PS/2 Model 80 in all BYTE's benchmarks. It enjoys a slight advantage over the Compaq 386/20 in most of the tests and is in a dead heat with the ALR Flex-Cache 20386. The comparative benchmark tests show little difference between these three computers in terms of overall performance, so other factors such as price, service, or expandability may be the distinguishing factors.

Sometimes increased performance comes at the expense of software incompatibility. However, I had no trouble running WordPerfect 4.2 and 5.0; BRIEF 2.1; Turbo C 1.5; Quattro 1.0; Dan BrickLin's Demo II 1.0; and Microsoft C 5.1. The system also ran through the application benchmark suite without a hitch.

While my review machine had an 8-bit VGA board, Dell says that the System 310 will be shipping with 16-bit boards by the time you read this. This is likely to change the video- and graphics-oriented benchmarks.

**Expansion Options** 

Physically, the System 310 closely resembles other large MS-DOS microcomputers. It has a 200-watt power supply, and the front right corner has room for three half-height drives. Only the top two spaces are suitable for floppy disk drives or a tape backup unit, though; the bottom space is suitable only for a hard disk drive because the front case covers most of it. My system's Mitsubishi 1.2megabyte 51/4-inch floppy disk drive and Sony 1.44-megabyte 3½-inch floppy disk drive fit into the top two slots.

To the left of these slots is another storage bay that can accommodate either two half-height hard disk drives or a single full-height hard disk drive. The front case completely covers these slots. The review system's Control Data Corp. halfheight 90-megabyte ESDI hard disk drive was mounted in the bottom of this storage

The system includes eight expansion slots. Six of them use the 16-bit IBM PC

# Dell System 310

# APPLICATION-LEVEL PERFORMANCE

Dell System 310 18.2\*

WORD PROCESSING			DATABASE	
XyWrite III + 3.52	Medium	Large	dBASE III + 1.1	-10
Load (large)	N/A	:10	Сору	:49
Word count	:02	:16	Index	:05
Search/replace	:04	:18	List	1:03
End of document	:01	:10	Append	1:32
Block moves	:08	:08	Delete	:01
Spelling check	:07	:47	Pack	1:18
Microsoft Word 4.0			Count	:03
Forward delete	:1	0	Sort	:51
Aldus PageMaker 1.0a				
Load document	:	07	Index:	2.84
Change/Bold	:	19		
Align right	-	15	SCIENTIFIC/ENGINEERING	
Cut 10 pages		13	AutoCAD 2.52	
Place graphic	:0	04	Load SoftWest	:34
Print to file	1:3		Regen SoftWest	:27
1 11111 10 1110			Load StPauls	:07
Index:	3.4	45	Regen StPauls	:05
- maoxi			Hide/redraw	8:37
SPREADSHEET			STATA 1.5	
Lotus 1-2-3 2.01			Graphics	:16
Block copy		:02	ANOVA	:10
Recalc		:01	MathCAD 2.0	.10
Load Monte Carlo		:09	IFS 800 pts.	:11
		:09	FFT/IFFT 1024 pts.	:11
Recalc Monte Carlo			FF1/1FF1 1024 pts.	
Load rlarge3		:02	□ Indaw	4.98
Recalc rlarge3		:01	☐ Index:	4.90
Recalc Goal-seek		:02		
Microsoft Excel 2.0			COMPILERS	
Fill right		:04		
Undo fill		1:28	and the state of t	3:04
Recalc		:02		
Load rlarge3		:17	Pascal S compile	:03
Recalc rlarge3		:01	Index:	3,41
☐ Index:		3.56	illuex.	0.41

Compaq 386/20 17.9 IBM PS/2 Model 80-111 13.2 IBM PC AT 18.2 Word Processing Spreadsheet Database Scientific/ Engineering Compilers \*Cumulative applications index. Graphs are based on indexes at left and show relative

All times are in minutes:seconds. Indexes show relative performance; for all indexes, an 8-MHz IE

# LOW-LEVEL PERFORMANCE1

CPU	0.00	DISK I/O		VIDEO	
Matrix	3.30	Hard Seek <sup>3</sup>	0.00	Text	2.00
String Move		Outer track	3.33	Mode 0	3.92
Byte-wide	21.48	Inner track	3.33	Mode 1	3.90
Word-wide		Half platter	6.67	Mode 2	3.77
Odd-bnd.	29.10	Full platter	9.96	Mode 3	3.75
Even-bnd.	10.75	Average	5.82	Mode 7	N/A
Doubleword-wide		DOS Seek		Graphics	
Odd-bnd.	21.03	1-sector	7.42	CGA:	
Even-bnd.	5.38	32-sector	19.25	Mode 4	1.46
Sieve	17.78	File I/O4		Mode 5	1.49
Sort	13.34	Seek	0.09	Mode 6	1.54
		Read	0.05	EGA:	
Index:	3.91	Write	0.80	Mode 13	3.42
_ maoxi	0.0.	1-megabyte		Mode 14	3.68
FLOATING POINT		Write	3.09	Mode 15	N/A
Math	6.08	Read	2.94	Mode 16	3.68
Error <sup>2</sup>	0.00E+00			VGA:	
Sine(x)	2.01	Index:	3.21	Mode 18	3.81
Error	2.00E-09	- IIIdox.	0.21	Mode 19	1.50
	2.23			Hercules	N/A
ex				Tiercules	19/7
Error	1.00E-09			Index:	2.45

CONVENTIONAL BENCHMARKS

Livermore Loops<sup>5</sup> (MFLOPS)

(Dhry/sec)

Dhrystone (MS C 5.0)

6596.00

LINPACK

Index:

N/A=Not supported by graphics adapter.

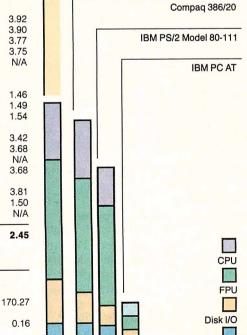
1 All times are in seconds. Figures were generated using the 8088/8086 and 80386 version (1.1) of Small-C.

- <sup>2</sup> The errors for the floating-point benchmarks indicate the difference between expected and actual values, correct to 10 digits or rounded to 2 digits.
- 3 Times reported by the Hard Seek and DOS Seek are for multiple seek operations (number of seeks performed currently set to 100).

  4 Read and write times for the File I/O benchmarks are in seconds per 64K bytes.

8.38

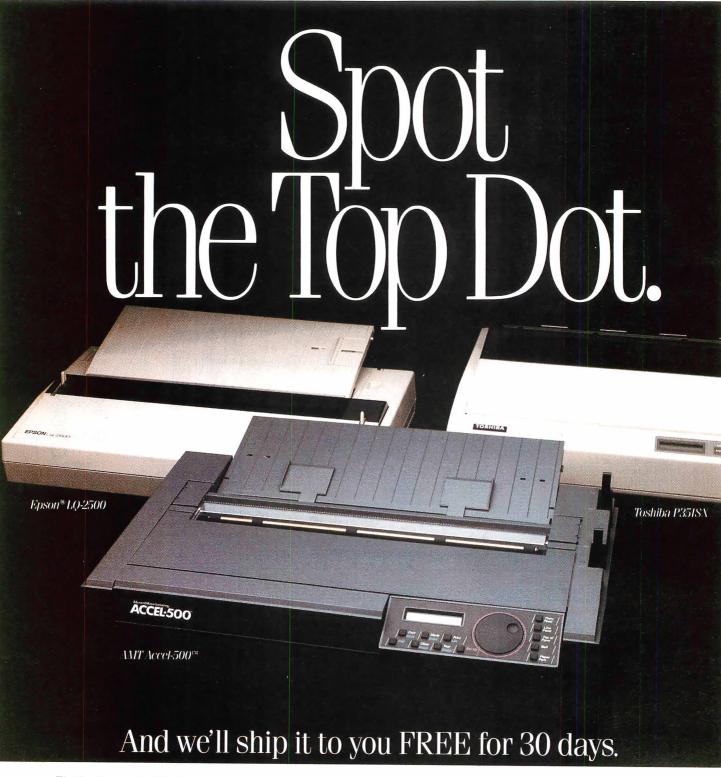
<sup>5</sup> For the Livermore Loops and Dhrystone tests only, higher numbers mean faster



Dell System 310

For a full description of all the benchmarks, see "Introducing the New BYTE Benchmarks," June BYTE.

Video



The bad news is, this is a quiz. The good news is, we're going to make it easy.

All three of these 24-pin dot matrix printers are versatile, rugged office-quality printers. They all provide a variety of type styles and compatibility with most popular software. But there's only one Top Dot. And all the clues you need to find it are right here in this ad.

Top Dot's high performance features include combined letter-

quality text and graphics, color printing, and a sizzling 480 cps draft speed.



SelectDial puts total printer control at your fingertips.

A unique Select-Dial™ feature gives Top Dot effortless, fingertip control. And plug-in Intelli-Cards™ provide instant software upgrades.

Top Dot's \$1085 price is a remarkable \$400 below comparable printers. Even more remarkably, it includes toll-free hotline support, a 2-year warranty, an unheard-of full year of on-site service, and for \$25, a Quick-Start kit packed with \$150 worth of supplies, software, documentation and more.

Epson is a registered trademark of Seiko Epson Corporation. Accel-500, Select-Dial and Intelli-Card are trademarks of Advanced Matrix Technology, Inc. ©1988 Advanced Matrix Technology, Inc.

# BUCKING THE SYSTEM

And only Top Dot is available in your choice of finish: Executive Black or traditional Ivory.

You have to visit a dealer to buy two of the printers on this page. But you can get Top Dot delivered to your door by UPS.®

Just call 1-800-637-7878, correctly identify the Top Dot, and

		COMPARISON CHART				
		AMT	Epson	Toshiba		
		Accel-500	LQ-2500	P351SX		
	Print speed					
	(12cpi)		5.55	0.00		
	Draft Mode	480 cps	324 cps	300 cps		
	Memo Mode	200 cps	N/A	N/A		
	LQ Mode	80 cps	90 cps	100 cps		
	Plug-in fonts	card	card	cartridge		
	Color printing	standard	N/A	optional†		
١	Warranty	24 mo	18 mo	18 mo		
l	On-site service	1 yr	N/A	N/A		
	Price	\$1085	\$1449††	\$1499 ††		
	Starter Kit	\$25	N/A	N/A		

+\$239 ++ manufacturer's suggested list price

we'll ship it to you. FREE.\* If after 30 days, the Top Dot hasn't become indispensable to your office, just send it back. Otherwise, do nothing. We'll charge \$1085 to your credit card or bill you against your purchase order. That's all there is to it.

And if you're still not sure of the answer, don't worry. Our operators will give you three chances to get it right.



Quick-Start Kit contains supplies, cable, software, documentation—even transparency materials. A \$150 value for only \$25 with Top Dot.

# **ACCEL-500**°

1-800-637-7878





Ventura Peripherals 100 Rancho Road, Suite 27 Thousand Oaks, California 91362

\* Offer subject to availability and credit approval.

AT-type bus, and the other two use the 8-bit IBM PC bus. The half-length VGA card on my machine occupied one 8-bit slot, and a Western Digital 1007 ESDI controller disk resided in one 16-bit slot. The latter uses a 1-to-1 interleave and has a data transfer rate of 651K bytes per second. It includes cabling for two floppy disk drives and two hard disk drives and has power supply connectors for four disk drives.

The System 310 has three standard display options: VGA monochrome, standard VGA, and VGA Plus. All use the same VGA card and differ only in the type of monitor included. Monochrome and EGA displays are also available.

Paradise makes the principal verylarge-scale-integration chip on the VGA display adapter. My review unit came with a 14-inch Mitsubishi VGA Plus monitor, which has a 0.31-millimeter dot pitch. This adapter/monitor combination gives crisp color graphics at up to 640 by 480 pixels in 16 colors and provides high-quality text. By contrast, the standard VGA color monitor offers similar resolution, but at a dot pitch of 0.42 mm. The monochrome monitor displays 16 shades of gray at 640 by 480 pixels. Unlike IBM's PS/2 computers, the System 310's display chips are on expansion boards, not on the motherboard.

My one complaint about the Dell System 310's hardware is that it's noisy. The cooling fan was louder than that in any other system I've seen, and a highpitched tone emanated from somewhere within the depths of the hardware.

My machine worked fine during my evaluation, but it failed to boot during testing in the BYTE Lab. Calls to Dell revealed that the machine had a defective ROM BIOS (version 1.10 08). Two new ROM chips (version 1.10 09) failed to solve the problem, however. Dell then sent a new motherboard with the new BIOS installed, and the System 310 worked fine. The company says that all machines it has shipped to customers have the newer BIOS chips.

**Finishing Touches** 

In addition to MS-DOS 3.30, Dell includes 15 enhanced utility programs that make the operating system easier to manage.

The utilities are more useful and easier to use than a handful of similar public domain or even commercial software programs because of the uniformity in command-line argument syntax and the similarity of their help screens.

The System 310 includes Microsoft MS-DOS and GWBASIC manuals and an

owner's manual that gives clear, liberally illustrated instructions on setting up the system. Dell also bundles Microsoft's Windows/386 software with the System 310.

Dell sells its computers by mail order only and has a toll-free number for technical assistance. The support technicians I spoke with were knowledgeable and responded to my questions quickly. As part of Dell's 1-year warranty, Honeywell Bull provides on-site service for customers who live within 100 miles of one of Honeywell's 180 customer-service dispatch offices, and you can extend the service contract for up to 4 years.

## A Dollar Saved

Compared to the Compaq Deskpro 386/20 and the ALR FlexCache 20386, the System 310 is a better value. My review unit, at \$7000, is about \$6000 less than a comparably configured 386/20. Substitute a 150-megabyte ESDI hard disk drive and, at \$7598, the System 310 is some \$2000 less than a similarly equipped FlexCache.

The only drawbacks to the System 310 were its noisy fan and the limitations on its expansion bay configuration. You can access only two of the five expansion bays from the front of the case, so you can't install two floppy drives and an internal tape backup unit, for example.

Do you need the kind of performance this computer delivers? For many users, the answer will be no. A zero-wait-state 80286 machine with a 12- or 16-MHz CPU will give you most of the qualitative "feel" of speed and instant response that the System 310 gives when running applications such as a word processor or spreadsheet.

But others need to stay at the leading edge of hardware and software development. A high-performance 80386 is a necessity if you want to be able to move quickly into all the generations of OS/2 as they develop or to run Unix on a microcomputer that's powerful enough to let this operating system work as it should.

For such users, the System 310 has much to recommend it. It exhibits flawless high performance, its hardware design and components are among the best available, and it's priced right. For my money, the System 310 is the system to beat.

John Unger is a geophysicist for the U.S. government and lives in Hamilton, Virginia. He writes graphics software and uses computers to study the earth's crust. He can be reached on BIX as "junger."

# HARDDRIVES



Includes drive, AT mounting hardware & "Disk Manager" partitioning software

Also available for XT

**40Mb** ST251 PC/XT KIT

Includes drive, controller, cables, How-To manual, mounting hardware & partitioning software.

Drives and Kits are available for All PS/2 models!

# 30 Day "Worry-Free" Guarantee

If for any reason, you are not completely satisfied with any product, simply return it for a prompt and courteous refund!

# 20<sub>Mb</sub> ST225 KIT

Complete PC/XT KIT includes drive, controller, cables, How-To manual & mounting hardware.

Seagate 150Mb KIT

Complete kit includes drive, cables, Perstor ADRT controller, How-To Manual, mounting hardware and "Disk Manager" partitioning software. Full Height. 28ms access time.

Complete PC/XT KIT includes drive, controller, cables, How-To manual & mounting hardware.

# **Macintosh Drives**

Complete PC/XT KIT

Internal drive kits are now available for Macintosh SE and II as well as external kits for Macintosh Plus!

Call for pricing!

We carry the entire Seagate product line including 3.5" drives

# **O S** Mb ST277R

40ms access • Half Height Autoparking heads This drive requires an RLL controller

Includes drive, mounting hardware & "Disk Manager" partitioning software

# High Speed 40Mb

Seagate ST251-1

28ms access • Half height • Auto parking heads Also available for XT

Includes drive, AT mounting hardware & "Disk Manager" partitioning software

# Card Drive

# **Hard Cards**

Card Drive 20S 40ms \$319

Card Drive 30S 40ms \$349

Card Drive 50S 40ms \$499

# -- Features --

- Available for most Tandy models
- · Quality engineered for reliability
- Super easy installation & setup
- ONE YEAR Warranty
- · Auto park heads

These Card Drives use quality Seagate Hard Drives

Toll Free Customer Service: (800) 541-8387



Help is just a phone call away with our **Technical Assistance** Department!

No Surcharge for Visa or MasterCard Orders

Hours: 8am to 7pm Monday - Friday, 12pm to 5pm Sat. MST

International Orders call: (602) 784-1038

HARD DRIVES International







1208 E. Broadway Road #110 • Tempe, AZ 85282

(602) 784-1038 FAX: (602) 829-9193

Prices and availability subject to change without notice. All items are NEW with manufacturer's warranty. 5% surcharge for American Express and COD orders. P.O.'s accepted NET 10 - subject to 9% surcharge. Add \$10 shipping for APO/FPO orders. 30 Day Guarantee conditions: shipping & handling charge is not refundable; product must be in original condition.



# The Odd Couple



The Amstrad PPC640 and Epson Equity LT portables have little in common

Wayne Rash Jr.

here could hardly be a greater contrast between the Amstrad PPC640 and the Epson Equity LT. The PPC640 is so large that it will fit on no lap of which I'm aware, and it has dual floppy disk drives. The Equity LT, which will fit on a lap, has a floppy disk drive and a 20-megabyte hard disk drive.

The Equity LT is by far the more traditional of the two machines. It closely resembles other laptops, such as the NEC MultiSpeed HD (June BYTE). The Equity LT features a V30 CMOS processor running at 10 MHz and 640K bytes of RAM. My review unit of the Epson Equity LT had a 9%- by 41/2-inch backlit, supertwist, liquid crystal display (LCD) screen with blue characters on a silver background. It also had an internal 20megabyte hard disk drive and a 720Kbyte 3½-inch floppy disk drive. The re-

view unit also came with an internal 1200-bit-per-second modem. As outfitted, this machine costs \$3767.

The Amstrad PPC640, designed in the U.K., is hardly traditional. It features an unusual case design. It has a full-width, IBM PC AT Enhanced-style keyboard and a 6%- by 4%-inch supertwist LCD screen, and it runs on 10 C-cell batteries. The system has an 8086 CPU running at 8 MHz, 640K bytes of RAM, dual 720Kbyte 3½-inch floppy disk drives, and an internal 2400-bps modem. This is a large machine, too wide and too long to fit on a lap-and even if it would fit, the keyboard is hinged in such a way as to make laptop use impossible. It is primarily designed as a portable for desktop use. This computer will run you \$1199.

There are some similarities between the two machines, though. Both are compatible with the IBM PC XT. They both use 3½-inch floppy disk drives. Finally, they both let you use an external monitor so that you can avoid eyestrain in the office.

# The Epson Equity LT

If you're planning to use a computer while traveling, the Equity LT's design makes it a good choice. With the backlit LCD screen and the hard disk drive, it's convenient to use on an airplane or in an office. The relatively light weight and slim profile make it easy to carry.

The Equity LT's screen swings up to reveal a modified version of the AT's Enhanced keyboard. The Caps Lock key is located next to the A, and the Control keys are on the lower corners of the keyboard. Across the top of the keyboard is a string of 10 function keys, rather than the 12 found on other versions of the Enhanced keyboard.

A full numeric keypad is just to the right of the alphabetic keys. Above that are a bank of LEDs and a tiny door that covers a group of switches. The LEDs monitor such things as battery condition continued

The Amstrad PPC640 (left) and Epson Equity LT (right).

# **Amstrad PPC640**

# Company

Amstrad, Inc. 1915 Westridge Dr. Irving, TX 75038 (800) 237-3116 (214) 518-0668

## Components

Processor: 8086 running at 8 MHz; socket for optional 8087-2 math coprocessor

Memory: 640K bytes of RAM

Mass storage: Two 720K-byte 31/2-inch

floppy disk drives

Display: CGA or monochrome on internal LCD or external monitor Keyboard: 101-key full-size Enhanced-

style layout

I/O interfaces: One parallel port; one serial port; RGB video connector Other: 2400-bps Hayes-compatible modem

# Size

191/2 × 161/2 × 4 inches (open); 12 pounds

### Software

MS-DOS 3.3; SoftKlone Mirror II; PPC Organizer

## **Options**

None

# **Documentation**

354-page Amstrad Portable PPC; 29page PPC Organizer Software

PPC512 (with 512K bytes of RAM and one floppy disk drive): \$899 PPC512 (with 512K bytes of RAM and two floppy disk drives): \$999 PPC640 (with 640K bytes of RAM, two floppy disk drives, and a 2400-bps modem): \$1199

Inquiry 884.

and the disk drive activity, as well as the current condition of Num Lock, Caps Lock, and Scroll Lock. The switches beneath the door control the appearance of the screen, the CPU clock speed, and whether the machine uses the built-in screen or an external monitor.

On the right side of the machine is the 720K-byte 3½-inch floppy disk drive. On the dual-floppy disk version, there is a companion drive on the left side; in my review unit, the hard disk drive resided on the left side. In the rear are connectors for a serial port and a parallel port, a

# **Epson Equity LT**

# Company

Epson America, Inc. 2780 Lomita Blvd. Torrance, CA 90505 (800) 922-8911

# Components

Processor: NEC V30 running at 4.77 or 10 MHz

Memory: 640K bytes of RAM Mass storage: 720K-byte 31/2-inch floppy disk drive; 20-megabyte 31/2-inch hard disk drive

Display: CGA on internal backlit LCD or external monitor

Keyboard: 85-key modified Enhanced-

style layout

I/O interfaces: One serial port; one parallel port (configurable as external floppy disk drive port); RGB video connector; proprietary expansion bus for modem card or memory expansion

### Size

131/2 × 121/4 × 31/4 inches; 141/5 pounds

## Software

MS-DOS 3.2; GWBASIC 3.2; Xtree disk management utility

# **Options**

Supertwist LCD screen: \$299 Backlit LCD screen: \$499 1200-bps modem: \$299 Carrying case: \$49 Cigarette lighter adapter: \$29

## **Documentation**

140-page Equity LT User's Guide; 376page Equity LT MS-DOS 3.20; 404-page Equity LT GWBASIC 3.20

# **Price**

Equity LT with dual floppy disk drives: \$1899

Equity LT with 20-megabyte hard disk drive and 720K-byte floppy disk drive: \$2999

System as reviewed: \$3767

# Inquiry 885.

CGA monitor, and a power connector. There are also a power switch and a series of DIP switches that select the assignment of the parallel and serial ports. One switch allows the parallel port to double as a connector for an external floppy disk drive. If you choose that option, however, you lose the ability to use a parallel printer.

The carrying handle slides out from beneath the front edge of the keyboard. This is a handy location for carrying the computer, but it results in a ridge directly in front of the space bar on the keyboard.

This ridge interfered with my typing.

The Equity LT can use a reflective or backlit LCD screen. You can remove the LCD screen and set it aside, which makes using an external monitor easier. If you have an external monitor, you could use this machine as your only computer.

Epson includes a reference disk that makes the Equity LT more convenient to set up and also provides sophisticated diagnostics should something go wrong. For daily use, Epson has provided the convenient Xtree disk management utility. Xtree supports several of the more common MS-DOS functions through a menu system. The Equity user's guide is well organized and illustrated.

# **Power User**

The Equity LT can run on AC or internal battery power. The AC adapter recharges the batteries when the computer is off. A complete recharge of the batteries, which are composed of eight nickel-cadmium cells, takes 12 hours.

Epson designed the screen so that the backlighting will turn off after a userselected period of minutes to help save battery power. In addition, you can turn the internal modem and hard disk drive on and off as required. Since modems and hard disk drives are heavy users of power, keeping them turned off can do a lot to extend battery life.

In spite of all this, the batteries, when fully charged, can run the machine only for slightly less than 2 hours, and the low-battery light begins flashing after 11/2 hours. These times are based on my use of the computer with very little hard disk activity and with the screen backlighting turned off about 80 percent of the time.

# Amstrad's PPC640

The PPC640 seems an eccentric machine in some ways. Its most noticeable characteristic is its layout. It does not look like any other computer in the marketplace. In large part, this is due to the full-size Enhanced keyboard that graces the machine. It is also partly due to the small screen located on the left side of the machine's top surface.

The PPC640 makes a strong impression from the first time you open the case and look at it. It's wide. Counting the comfortable plastic handle on the right side, it's 19½ inches wide, as compared to the Equity LT's 13½-inch width.

The keyboard folds out from the top toward you. This is a full-size 101-key, AT Enhanced-style keyboard, with

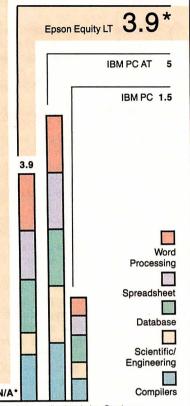
#### Amstrad PPC640, Epson Equity LT



#### APPLICATION-LEVEL PERFORMANCE

WORD PROCESSING XyWrite III + 3.52	Amstrad Med./Lrg.	Epson Med./Lrg.	DATABASE dBASE III+ 1.1*	Amstrad	Epson
Load (large)	:27	:24	Сору	N/A	2:49
Word count	:10/:74	:08/:57	Index	N/A	:29
Search/replace	:18/:58	:14/:45	List	N/A	:28
End of document	:05/:33	:04/:24	Append	N/A	5:02
Block moves	:31/:30	:20/:19	Delete	N/A	:05
Spelling check	:43/4:39	:26/3:12	Pack	N/A	3:12
Microsoft Word 4.0	. 10/ 1.00	.20,02	Count	N/A	:24
Forward delete	1:23	:56	Sort	N/A	2:31
Aldus PageMaker 1.0a		.00			
Load document	N/A	:25	Index:	N/A	0.92
Change/Bold	N/A	:76			
Align right	N/A	:59	SCIENTIFIC/ENGINE	ERING	
Cut 10 pages	N/A	:50		Amstrad	Epson
Place graphic	N/A	:13	AutoCAD 2.52*		
Print to file	N/A	5:35	Load SoftWest	N/A	6:56
111111111111111111111111111111111111111			Regen SoftWest	N/A	6:40
Index:	N/A	1.02	Load StPauls	N/A	1:55
			Regen StPauls	N/A	1:47
SPREADSHEET	Amstrad	Epson	Hide/redraw	N/A	1:26:25
Lotus 1-2-3 2.01			STATA 1.5		
Block copy	:23	:10	Graphics	3:31	2:41
Recalc	:06	:04	ANOVA	2:23	1:53
Load Monte Carlo	2:55	:51	MathCAD 2.0		
Recalc Monte Carlo	:26	:20	IFS 800 pts.	4:32	3:34
Load rlarge3	:42	:12	FFT/IFFT 1024 pts.	5:31	4:13
Recalc rlarge3	:04	:03	**************************************		
Recalc Goal-seek	:12	:10	☐ Index:	N/A	0.34
Microsoft Excel 2.0*					
Fill right	N/A	:14	COMPILERS	Amstrad	Epson
Undo fill	N/A	6:28	Microsoft C 5.0*		
Recalc	N/A	:05	XLisp compile	N/A	12:5
Load rlarge3	N/A	1:12	Turbo Pascal 4.0		
Recalc rlarge3	N/A	:05	Pascal S compile	:43	:14
☐ Index:	N/A	0.86	Index:	N/A	0.81

All times are in hours:minutes:seconds. Indexes show relative performance; for all indexes, an 8-MHz IBM PC AT=1. \*Not run on the Amstrad PPC640. The PPC640 is limited to 720K-byte floppy disks and could not run tests where the program and files exceeded 720K bytes. We were unable to compute an application index for the Amstrad PPC640.



\*Cumulative applications index. Graphs are based on indexes at left and show relative performance.

Amstrad PPC640

Index:

N/A

LOW-LEVI	EL PERFOI	RMANCE1							JI.
CPU Matrix	Amstrad 20.16	<b>Epson</b> 15.76	DISK I/O Hard Seek	Amstrad	Epson	VIDEO Text	Amstrad	Epson	
String Mo			Outer track	N/A	9.20	Mode 0	18.18	13.79	
	113.37	87.17	Inner track	N/A	9.24	Mode 1	18.18	13.81	
Word-wid			Half platter	N/A	23.05	Mode 2	15.71	14.96	
	d. 113.37	87.16	Full platter	N/A	27.65	Mode 3	15.71	14.96	
Even-bn	d. 56.74	43.61	Average	N/A	17.28	Mode 7	N/A	N/A	
Sieve	109.41	84.25	DOS Seek <sup>3</sup>	.4		Graphics			
Sort	86.61	67.23	1-sector	77.55	39.18	CGA:			
			32-sector	432.14	107.46	Mode 4	7.76	6.08	
Index:	0.72	0.93	File I/O <sup>5</sup>			Mode 5	7.80	6.08	
	- 100		Seek	0.59	0.41	Mode 6	8.13	6.36	
FLOATING	G-POINT <sup>2</sup>		Read	13.22	2.12	EGA:			
	Amstrad	Epson	Write	12.92	2.08	Mode 13	N/A	N/A	
Math	N/A	N/A	1-megabyte	В		Mode 14	N/A	N/A	
Error	N/A	N/A	Write	N/A	N/A	Mode 16	N/A	N/A	
Sine(x)	N/A	N/A	Read	N/A	N/A				-
Error	N/A	N/A				Index:	0.66	0.82	
e <sup>x</sup>	N/A	N/A	Index:	N/A	0.57				
Error	N/A	N/A							

1 All times are in seconds. All figures were generated using the 8088/8086 version (1.1) of Small-C (16-bit integers).

N/A

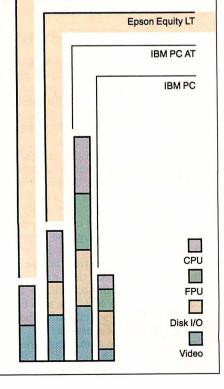
- <sup>2</sup> Floating-Point benchmarks were not performed because the Epson Equity LT and Amstrad PPC640 did not have a math coprocessor chip.

  The Amstrad PPC640 did not have a hard disk drive; all times are for floppy
- disk drives
- 4 DOS Seek times for the Epson Equity LT are for multiple seek operations (number of seeks performed currently set to 100).

  Read and write times for the File I/O benchmarks are in seconds per 64K
- 6 For the Livermore Loops and Dhrystone tests only, higher numbers mean faster performance. Tests were performed in emulation mode.

#### CONVENTIONAL **BENCHMARKS** Amstrad Epson LINPACK 9307.62 7189.36

Livermore Loops<sup>6</sup> (MFLOPS) 2.30E-03 3.00E-03 Dhrystone (MS C 5.0) (Dhry/sec) 1103.00 1438.00



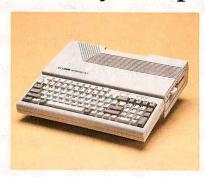
#### Not Really a Laptop

In addition to the other laptops in this review, I also looked at the Laser Compact XT (available from Video Technology Computers, Inc., 550 East Main St., Lake Zurich, IL 60047, (312) 540-8086).

The Laser Compact XT is a dual-speed (4.77- and 10-MHz) IBM PC XT clone with no expansion slots and meager documentation. This minimalist computer is sold for a minimal price—\$599 for the base model with 512K bytes of RAM, and \$699 for the 640K-byte model.

The idea behind the Laser Compact XT appears to be to provide a full-featured clone for as small a price as possible. In this its designer seems to have succeeded.

This machine is about the size of a laptop computer that contains its single 360K-byte 5¼-inch floppy disk drive on the right side of the machine. It is equipped with 1.6 megabytes of memory, CGA and Hercules graphics, a parallel port, a serial port, a joystick or mouse port, and an external disk drive connector for the optional external 360K-byte floppy disk drive. It comes with RAM disk software, so the lack of a second floppy disk drive is not a big problem. Finally, it weighs less than 12 pounds and has a handle that folds out



from underneath so you can carry it around.

#### Using the Laser Compact XT

Getting the Laser Compact XT set up is a chore. The documentation is both slim and vague. When I tried to set the video board to handle a CGA monitor, I found the documentation so confusing that I had to call the manufacturer's technical hot line to get the proper instructions.

Once I got the Laser Compact XT set up, it performed adequately. It supported CGA when I had the switches set properly, although the character set was smeared and hard to read. The machine was shipped with MS-DOS 3.21 and GWBASIC. Unfortunately, the RAM disk drivers were shipped on a boot disk with MS-DOS 3.20; I had to jockey the

disks around until I could get the newer version of DOS onto the memory driver boot disk. This could be a problem for a new user.

There seemed to be no problem with compatibility for the software I tried, which included WordStar 4.0, Lotus 1-2-3 version 2.01, and some games, such as Tetris. There were no problems with copy protection at high speed when I used Lotus 1-2-3.

The keyboard occasionally doubled characters, and it was hard to use unless the rear of the machine was propped up on its carrying handle. Once oriented like this, the keyboard was farther off the tabletop than is the case with a detached keyboard on an IBM clone.

#### The Occasional Computer

This is a machine for people who sometimes want to work at home or who sometimes need an IBM compatible. It is quite portable, although you will need a monitor where you are going—unless you plan to carry that, too.

The Laser Compact XT is not dependable enough to be a primary computer. It does what it advertises, but you can't add expansion cards. If one floppy disk drive and a RAM drive are what you need, then this might make an acceptable secondary machine.

every key faithfully placed in its proper location.

The main section of the computer has a small screen on the left side. The screen will tilt to any position, from perfectly flat to nearly upright, so you can adjust the angle for better viewing. Adjusting the angle is important, because the Amstrad PPC640 uses a reflective LCD screen. The supertwist LCD screen is reasonably clear, but it's much harder to see than a backlit display. This machine needs either an external monitor or good room lighting.

Beneath the display are cooling vents; for them to work properly, the display needs to be tilted upward. The PPC640 stopped running twice during the course of this review, and each time it started again after I raised the screen and allowed the machine to cool. The area beneath the screen gets warm, but not hot, during long periods of operation.

Next to the screen is a small cubbyhole that can hold a telephone cord for the built-in 2400-bps modem. Below that are

controls for screen contrast and speaker volume, and a series of LEDs that show disk drive activity, whether the CRT is enabled, and whether the power is on. Below the LEDs is a switch that controls the power source.

Power in the Amstrad PPC640 comes from 10 C-cell alkaline batteries or from an AC adapter. The user's manual advises against using rechargeable batteries. Amstrad also provides a 12-volt car adapter that you can plug into your cigarette lighter. The C-cell batteries lasted about 3 hours before the battery alarm sounded; during that time, the PPC640 ran the BYTE benchmarks twice.

On the right side of the PPC640 is a square plastic handle that protrudes from the carrying case so you can carry the computer securely. Next to the handle is a pair of 720K-byte 3½-inch floppy disk drives. An internal hard disk drive is not available. On the rear of the machine is a door that swings open to reveal a serial port, a parallel port, a DIN connector for power, a coaxial DC power connector,

an RGB monitor connector, and a pair of RJ-11 connectors for the modem.

#### Hands on the PPC640

Once you get past the size, you'll find that Amstrad has added some software that makes the PPC640 easy to use. An integrated package called the PPC Organizer includes text retrieval, an appointment book, a card file, a word processor, and a calculator. It's a convenient package, and it supports a color monitor if you have one attached. Mirror II, a communications package, is also bundled with the system.

The PPC640 is extremely quiet. Since it does not have a hard disk drive, there's none of the whirring and whining that goes with one. The floppy disk drives are quiet and trouble-free.

Since the PPC640 has a full-size keyboard, it was easier to get used to than any other laptop I've reviewed. The keyboard is just like those on larger machines. If you do a lot of word process-

continued



# It looks good on paper.

You expect excellent letter-quality print from a 24-pin printer. And Citizen's new precision-built Tribute™ 124 delivers.

With razor-sharp letter definition at 66 cps. Attractive correspondence quality at 132 cps. As well as crisp, impressive draft

printing at 200 cps.

You might be surprised, however, to find that the versatile Tribute 124 offers quite a bit more. Like a built-in push or pull tractor with top, rear or bottom feed. Automatic paper loading. Outstanding compatibility. Push-button convenience of a front control panel. Even optional color printing.

It also provides a wide selection of typestyles via available font

cards. And produces striking high-resolution graphics.

With all these value-added features and an exceptional 12-month warranty, the Tribute 124 is very affordable. So, not only does it look good on paper, it looks good for less paper.

For the Citizen printer dealer nearest you, call 1-800-556-1234,

Ext. 34. In California, call 1-800-441-2345, Ext. 34.

©1988 Citizen America Corporation. Citizen, the Citizen logo and Tribute are trademarks of Citizen Watch Co., Ltd.



Printers that run like clockwork.

ing, this keyboard will fit right in.

The PPC640's documentation was adequate. The user's manual contained instructions for not only the computer but also MS-DOS and the Mirror II communications software.

#### **Spotty Benchmarks**

The BYTE Lab couldn't run the full suite of system benchmarks on these machines. The PPC640 lacked a hard disk drive, so running some software, such as

Aldus PageMaker and dBASE III Plus, was impossible. Neither machine had a math coprocessor chip, thus eliminating the FPU tests.

In the tests that the BYTE Lab could run, both laptops were adequate in benchmark performance. Even though both used 8086-level technology, they performed well when compared to the IBM PC XT; in many tests, both of them ran two to three times faster than the XT. Even when compared to the 80286-based AT, they put in a respectable showing.

The Equity LT consistently performed at 80 percent to 90 percent of the speed of the AT. In one test-the word-processing application benchmark-the Equity LT actually beat the AT by a small margin. Overall, this machine shows exceptional speed. There is one area, the Scientific and Engineering tests, where the processor's limitations (and lack of a math coprocessor) show up; I think it's unlikely, however, that this machine would be purchased for a heavy user of AutoCAD.

The PPC640 was also reasonably fast, especially for an 8086-based machine costing under \$1200 and running on flashlight batteries. It turned out a respectable half to two-thirds of the speed of the AT. Since this machine is designed to be a clone of the old XT, its benchmark performance was certainly adequate. The PPC640 could not run all the application benchmarks, but those it could handle indicate that it maintains its speed relative to the AT.

Interestingly, in sorting operations, the PPC640 was virtually as fast as the AT; this is probably due to the 16-bit data path the 8086 shares with the 80286.

#### Stick with Others

The Epson Equity LT is similar in style and price to portable computers available from other manufacturers, such as NEC or Toshiba. But the NEC MultiSpeed HD's keyboard is slightly easier to use, and the Equity LT's carrying handle causes an awkward ridge in front of the keyboard, making typing difficult. The Equity LT is basically a sound machine at a reasonable price, but in terms of overall convenience, I still prefer the NEC or Toshiba computers.

The Amstrad PPC640 is unique. It has no hard disk drive and no backlit display, but it has the best keyboard available on a portable. This makes typing easy, but it reduces the machine's portability. The PPC640 is similar in price to other machines, such as the Toshiba T1000, but it

has dual floppy disk drives.

Neither machine, though, succeeds in breaking new ground. If I were buying a laptop portable, I would stick with the NEC MultiSpeed HD, Toshiba T1000, or Zenith SupersPort.

Wayne Rash Jr. is a consulting editor for BYTE and a member of the professional staff of American Management Systems in Arlington, Virginia. He consults with the federal government on microcomputers and communications. You can reach him on BIX as "waynerash."

# Salikonnia

NLY \$2.99 per disk! ONLY \$2,99 per disk! ONLY \$2.99 per disk!

Public Domain and Shareware for IBM™ and Compatibles, DOS™ 2.1 or higher. ONLY \$2.99 per disk! Programs and Utilities to meet all your computing needs.

#### BUSINE

DEZ-FORMS Rev. D15 (66)
- Menu driven, misc. forms.
DEABY PROJECT V2.5
(1440) - Complete project
management system. Excellent.
DREAL ESTATE ANALYST (83) - Menu

driven, mortgages, interest, etc.

IN CONTROL (174 & 175) - (2 disk set)

The ultimate prospect/client/custo tracking system. Hard drive req. Grea DUSINESS LETTERS (303 & 304) disk seti 650 business lette your needs. Edit w/ any word processor.

LEGAL LETTERS (611) - 100 legal letters to fit all your needs. Edit w/ any

□ MR. BILL V3.2 (311 & 312) - (2 diak oth Const. Size vo. 2 (2) 1 & 312; 12 disk set) Time & billing package; costs, credits, reports, audit trail, etc.

LANDLORD V2.01 (585) - Fast &

friendly rental property mgmt. Hard drive

FINANCE MANAGER V4.0 (77) - Ac

ounting package for business or personal finances. Double entry system.

J PRO PC-ACCT SYSTEM [526] - Fully integrated G/L. A/P. A/R system. Menu driven, on screen help, cross posting, unlimited accounts, & much more.



#### COMMUNICATIONS

☐ QMODEM V3.1 (293 & 294) - (2 disk set) Full featured modem program. 200
number dialing directory, etc.

PROCOMM V2.42 [53 & 54] 12 disk PROCCUMM V2.92 [55 & 59] 12 GBR set) Menu driven modem program, excellent documentation; still one of the best.

PC-TALK III [466] - Modem program by



#### DATABASE

□ Price EXPRESS V4.18 (33 & 34) - 12 disk set! Menu driven, easy to use database for beginners to experience.
□ PC-PiLE + V2.0 (483 - 485) - 13 disk set! Full-featured database: help screens, menus, macros. One of the best. J Button



#### EDUCATION

COMPOSER (3) · Create, save edit, play, & print your music.

□ LETTERFALL V1.1 (119) - Im-COLOR PAGE SETTING THE SHIP COUNTY OF THE WORLD 3D [127]. Diplay map of the world. CGA required.

THE WORLD 3D [127]. Diplay map of the world. CGA required.

PUNNELS & BUCKETS V2.0 [130]. Great learning game: add, aubtract, multiply, divided, Ages 5-10.

MATHAMILE [188]. Teaches various math operations. Ages 5 and up. You choose the level. Bank required.

GAN MATEO BUCKTION [136]. Teaches math, chemistry & geography. Ages 5-10. CGA required.

POLYMICT VG.01 [139]. Vocabulary builder Grades 7: college. Excellent.

DANIMAL MATH/MOGAIC [181]. Count objects & graphic learning tool. Ages 4 & up. CGA required.



GAMES □ SLEUTH V4.1 (89) - Mur-der mystery game similar to der mystery game similar to the board game "CLUE".

BLACK.IACK (95) - Advanced blackjack

me with tutor, multiple players. B IOPOLY V6.7 (106) - Just like the DND V1.1 (205) The classic dungeon

game. Can you survive?

□ LAS VEGAS [116] - Craps. Roullete, Poker, & more. CGA req. Basic on some.

□ 3D CHESS VI.01 [215] - Excellent these game. Switch between 20 & 3D.

□ SUPER PINBALL [212] - S different games. CGA required.

□ WORDPLAY [367] - Wheel of Fortune clone. You provide the prizes. CGA req.

□ MINIATURE GGLP [305] - 16 hole golf course with graphics. CGA req.



#### GRAPHICS

Paint program; 6 fonts, 81 siz

☐ LIGHTING PRESS (266) Printmaster Plus clone, flyers, greeting

PRINTMASTER GRAPHICS (319) - 3 IIbraries of graphics. Printmaster Plus req.

PRINTSHOP GRAPHICS (320) - 3 IIbraries of graphics. Printshop req.

PC-KEY-DRAW (534-538) - (3 disk set) - Combination CAD & paint program

for power & flexibility.

□ DANCAD 3D V2.0B (424 & 425) - 12 sk set! Advanced 2D/3D drafting pro gram. 640k req.

□ FLODRAW V1.00 (542 & 543) - Pro

duces flowcharts, organizational charts, system diagrams, etc. CGA required.



#### NOVELTY

STRESS & SHRINK (74) .

STRESS & SHRINK [74].

Stress - atress test. Shrink - personality analysis.

PASTBUCKS [191] - Menu-driven home finance package. Easy to use.

RECIPES VI. 0 [446] - Over 125 recipes, adjust serving sides from 1-fres less propoket sized address book. Prints sinialphabetted pages.

HOMEBASE V.2. [528-590] - (3 disk set) Great desktop organiter; linear database, editor/word processor, calendar appt. book, cut/paste operations, etc.



#### PRINTER UTILITIE

□ LQ V2.1 (509) - Produc high quality text on dot mate printers. Multiple fonts wi

print spooler.

PRINTPRO V1.2 (468) - Change print operation from within ANY application BRADFORD (551) - Print any file w higher quality in a large variety of fonte



#### SPREADSHEET

| PC CALC + V 1.0 (537-539)
| 3 disk set! - Complete program. Buttonware.
| LOTUS PROGRAMS (28 - 32) - 15 dis

set) Contains as many applications a utilities that we could find. Lotus 123 n A8 EASY AS V3.0 (302) - Lotus clot 52 column sheet, graphing, suppor 52 column sheet, graphing, suppor functions of 123, "WKS" files, etc.



#### UTILITIES

DISK COMMANDO V2.0 (218 & 219) - (2 disk set) Norton Advanced Utilities clone. Too many features.

SIM-CGA (220) - Great for most programs that need color (Coarl to run.

DOS HELP (255) - Help screen for DOS commands, functions & batch files at your fingertips. For DOS 3.XX DOS TUTORIAL V4.2 (256) - Menu driven, learn to use your computer.

UST V6.2A (274) - Best utility for viewon or any ASCII file AUTOMENU V4.01 (280) - Access pro grams, batch files, commands, etc.

VACCINE [541] - Various programs
to fight against the "VIRUS" & "TROJAN HORSE" programs. A MUST FOR ALL... PROCESSING

PC-WRITE V2.71 (9 & 10)
(2 disk set) Full featured word
rocessor, all the features of the expen-

sive one's.

GALAXY V2.3 [11] • Easy to use word processor, menus & quick keyboard commands. Lots of features.



#### WHATS NEW?

□ WORDPERFECT MA-CROS (189) - Over 80 ma-cros for Wordperfect V5.0. □ ON-8IDE (560) - Sideways

printing program.

PDS QUOTE V3.14 (573) - Quickly prepare quotes for any project.

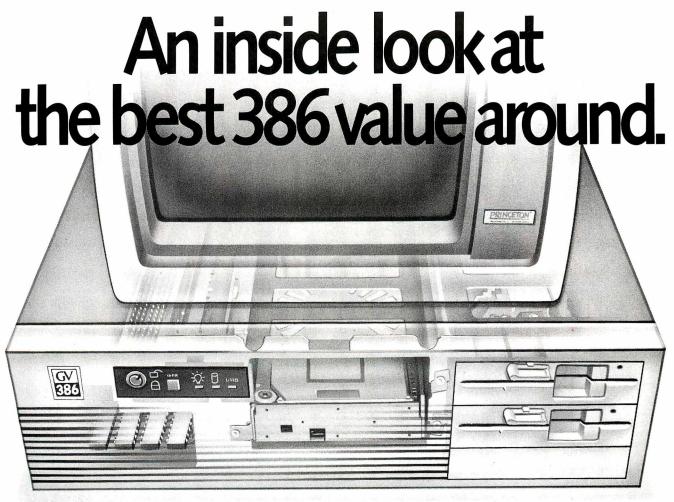
ALGEBRA TUTOR (577) - By professor Weissman, teaches all operations.

WEIGHT CONTROL (586) - Programs □ With I CON ROL [1989]. Programs designed to get rid of unwanted inches.
 □ BILLPOWER V3.9 [601]. A timekeeping, billing & bookkeeping program for small firms. Req. 450K & hard drive.
 □ MOMT TOOL8 [643]. 10 programs for management & supervisors. Great!

ni-	
sk a- ar	ORDER FORM  ORDER FORM
<u>S</u>	NAME
th	CITYSTZIP
er at	Multiple disk sets count as the # of disks in a set @ 62.99 each.
h	3.5" media - 63.99 ea # of 5.25" disks@62.99= CA Res. Sales Tax (6.5%) =
	Shipping & Handling = 3.00 Orders shipped UPS ground
	TOTAL = S ======= International orders add \$10.00 for S/H & psyment must be in US funds.
k	Mail order form & check or money order to: California FREEWARE
q.	1466 Springline Dr. Dept A
e. s	Palmdale, CA 93550 (805) 273-0300
A	Hours: M-F 8am - 5pm
٠.	Call or write for a free catalog containing over 700 disks of qualtiy software. Phone orders placed before 12pm PST
	sent same day. Yes - We accept VIBA/MC Orders.

BYTE1088

Please call for warranty information



The more you look into 386 compatibles, the more you realize that well thought-out design innovations (that really work) are few and far between.

That's why our engineers set out to design the GV-386. They realized they could unlock more of the chip's potential, if only they could speed up data retrieval, without affecting system reliability.

#### **INNER POWER**

Here's how they did it: a high-speed RAM cache

circuit—a full 64K of superfast memory—that puts your most frequently accessed data right at your fingertips. If you're ever involved in processing complex databases, long spreadsheets, or detailed engineering drawings, you'll see the value of this innovation in a second...literally.

Best of all, the cache circuit actually makes the GV-386 more reliable than other high-speed machines, by sparing integrated circuits from harsh overloading.

#### Our BBS is on-line 24 hours. Call The Soft Stop at 918-252-9137.

Prices subject to change

#### GV-386 Specifications

- ☐ Available with 16MHz or 20MHz CPU
- ☐ Zero Wait States
- ☐ 64K Cache (keyboard enabled)
- □ IMB RAM on-board, expandable to 4MB
- ☐ Socketed for 80287 or 80387
- □ I/O Bus runs at 8MHz for hardware compatibility
- ☐ Six 16-bit slots: Two 8-bit
- ☐ Price: 20MHz systems start at \$2,750; 16MHz systems as low as \$2,375

#### **QUALITY THROUGHOUT**

Of course, our most important criterion when designing our super compatible wasn't speed—it was quality. Take a look inside the GV-386 and you'll see it everywhere: from the highest quality components available to the intelligent use of special CMOS RAM to store system set-up information. On the outside, the fit and finish of the GV-386 would make Big Blue green. Even the user's manual has impressed users and reviewers alike.

We'd like to tell you more about what went into the GV-386. Give us a call and we'll give you the whole story. We'll also tell you about our exclusive 30-Day Compatibility Guarantee, our full One-Year Warranty and our tollfree support service.

The GV-386 from PC Designs. With design innovations this advanced, at this price, it's an open and shut case.

Call us now at 1-800-32-BIT PC

(800-322-4872)

2500 N. Hemlock Circle. Broken Arrow, OK 74012 \* 918-251-5550 (Fax: 918-251-7057)

19 Rector Street, Suite 2705, New York, NY 10006 \* 212-514-7280 (Fax: 212-797-3973)



FIVESTAR'S fleet of powerful business computers have really taken off in the last three years. That's because they're built for corporations that want to get where they're going in a hurry.

We build a full line of high-powered performers that not only provide *total* PC compatibility and advanced business capabilities, but also offer American-made ingenuity, quality and value.

In fact, when you *really* compare, you'll find that FIVESTAR Computers leave the competition far behind.

#### FIVESTAR 286's. The performance to fly through heavy workloads.

FIVESTAR 286's provide the features and performance aggressive companies need to reach higher corporate goals. In fact, they're designed to run future as well as current operating systems.

The 286/10 is powered by an Intel 80286 microprocessor that operates at a fast 10 MHz, with zero wait states. With 640KB memory and 1.2MB floppy disk drive, you'll soar through today's popular business applications. Serial, parallel and game ports, and an enhanced 101-key keyboard, provide in-flight convenience.

The 286/14 is also powered by an Intel 80286 CPU, but operates at 14 MHz (with zero wait states) for even faster performance. It, too, comes equipped with 1024KB memory, 1.2MB floppy disk drive, serial/parallel/game ports and a 101-key keyboard. No doubt about it — it's a hot machine and a dream to fly!

#### FIVESTAR 386's. Don't forget to fasten your seat belt.

The incredible speed and power of FIVESTAR 386's have made them a leading choice of corporations across America for multitasking and sophisticated applications, including CAD. In fact, there's so much performance and value built into our 386's, it can take your breath away.

The 386/16 is fast. Very fast. That's because it features an Intel 80386 CPU operating at

16 MHz, with zero wait states. And its 1024KB memory and 1.2MB floppy disk drive will keep you airborne for long distances. Serial/parallel/game ports and a smooth performing 101-key keyboard are standard equipment.

Prices: The 286/10 – from \$1099. The 286/14 – from \$1499.



The 386/20. It's made for those who want to fly to the outer limits. With an Intel 80386 microprocessor operating at 20 MHz (with zero wait states) it'll move through the most complex applications with astounding ease. And you won't have to worry about running low on memory either. It not only features 1024KB of RAM and a 1.2MB floppy disk drive, it also has a 64KB cache memory. Naturally, it comes equipped with serial/parallel/game ports and a 101-key keyboard, too.

#### Customize your FIVESTAR to meet your own specifications.

All FIVESTAR 286 and 386 Computers are available with hard drives, from 20 to 320 MB, as well as a choice of monochrome, EGA, VGA or super-high resolution paper-white monitors. Whatever the requirement, FIVESTAR can meet it.

Prices: The 386/16 – from \$1999. The 386/20 – from \$2999.

#### Unmatched reliability. Unbeatable ground support.

Because every FIVESTAR Computer is tested and certified to meet the highest standards of quality, you can count on years of reliable performance.

Once you've purchased your FIVESTAR computer, you'll get all the support you'll need. Just call our highly-trained service department *toll-free*. Most difficulties can be resolved within minutes.

For companies with critical applications, a comprehensive on-site service contract is available for just \$99. In most cases, service calls are made within 24 hours.

#### Order by phone today. And move your company to higher levels of performance.

To order a FIVESTAR 286 or 386 Computer, or for more information about our full line of high-powered computers, call us TOLL FREE. We'll have your hot new corporate jet parked in your hanger in no time!

1-800-752-5555



America's hottest new corporate jets.

All prices and specifications are subject to change without notice.

FIVESTAR and Intel are registered trademarks.

13108



# Bringing the Outside World

Five low-cost scanners for capturing images or text

Laurence H. Loeb

ithout a doubt, the Macintosh's built-in graphics ca-Desktop publishing is a good example of this: It requires a machine that can freely mix graphics and text, organize them, and then display them consistentlysomething that the Mac does very well. This ability to freely use graphical information to illustrate or amplify text has spawned many a newsletter that might have never been produced otherwise.

solve a fundamental problem for many people who wish to use them. Simply put, not everyone can draw the images they want.

This is where the scanner as graphics tool comes into the picture. A scanner is a piece of hardware that copies an image and converts it to an electronically usable form, either as an image in the Mac's RAM or as a file on disk. Once you get an image from, say, a book or magazine or snapshot into the Mac, you can then manipulate it with any of an army of Mac applications. You can import the image to an application either via the Clipboard or by opening the file.

Another use of scanners is in optical character recognition (OCR). With the right application, the Mac can analyze an image to recognize the presence of characters. This allows rapid data entry from paper documents and eliminates typing it in by hand, which is time-consuming and error-prone.

pability gives it uses that its designers never thought of.

However, these capabilities don't

Using What You've Got: ThunderScan

The ThunderScan uses your Imagewriter printer as the scanning mechanism (see photo 1); it replaces the ribbon assembly on the Imagewriter with an infrared scanning device. Software on the Mac

I took a look at five scanners designed for use with the Macintosh: Thunder-Ware's ThunderScan (\$249), Mirror Technology's VisionScan (\$695), Microtek Lab's MSF-300C scanner (\$1795 with small-computer-system-interface connector and cable), Datacopy's Model 730 (\$2495 with SCSI connector kit), and New Image Technology's MacScan (\$1995). I chose a price ceiling of about \$2500. This range by no means covers the entire Mac scanner market, but it should give a good picture of what's available at the low end and what the price/performance trade-offs are.

The least expensive scanners (ThunderScan and VisionScan) use the Mac serial port to convey data. The most costly scanners (the MSF-300C, Model 730, and MacScan) are flatbed devices that resemble small photocopiers and use the SCSI port to communicate with the Mac. The SCSI port allows faster data transfer rates between the Mac and the scanner than you get through the serial ports. All scanners except the VisionScan can save gray-scale information with an image.

To obtain some realistic, quantitative results, I scanned the same image with each scanner. The image was BYTE's standard test sheet (see figure 1). All scanned files were saved as bit mapsthat is, with no gray-scale information. All that can be shown on a Mac display (except for that of the Mac II) is bit-map information, so the scans all looked the same on-screen. For consistent results when saving the image to disk, I saved all the scans as 1-bit-per-pixel Tag Image File Format (TIFF) files. I used a Mac Plus with 2.5 megabytes of RAM using MultiFinder 6.0 with System 6.0.

controls the Imagewriter, using its carriage to advance the paper with the image on it up past the print head and moving the print head with the attached scanning device back and forth across the image. It scans by measuring the infrared reflection point-by-point as the scanning device moves across the paper.

The ThunderScan system is an ingenious way to use all the hardware of a typical Mac system to get scanning capability, since Mac users usually have a printer. But what if you have a Laser-Writer? Sorry, you're out of luck. What if you've got a book, rather than a photo or magazine page? If it can't fit into the Imagewriter carriage, again you're out of luck.

The scanning device feeds data to the control software via either serial port. ThunderScan draws 5 volts from the Mac for its power. In its original design, it obtained this power from the DB-9 serial ports on 128K-byte and 512K-byte Macs. But on the Mac Plus and SE, the DB-9 connectors have been replaced with mini DIN-8 connectors, and a 5-V source is not available. ThunderWare built a special PowerPort adapter, supplied with the scanner, that makes these machines electrically and cable-compatible to the original design.

The PowerPort adapter fits over the external floppy disk drive connector and draws the 5 V from it. A duplicate connector lets you attach an external drive to your Mac. The adapter also has a DIN-8 connector for the Mac's printer port, and these signals are provided on a DB-9 connector to the scanning device. Mac II users have to obtain a special PowerPort adapter since it doesn't have an external floppy disk drive connector.

Setup is amazingly simple. You remove the printer ribbon from your Imagewriter or Imagewriter II printer and clip the scanning device into its place. Then you attach the PowerPort adapter to the external floppy disk drive connector. Next, you attach the scanning



device's cable to the provided junction box, and the Imagewriter's printer cable to another connector on this box. Then you hook the junction box to the Power-Port connector. Finally, you copy the software to your start-up disk. Although this operation sounds involved, in just under 10 minutes I was ready to do my

The ThunderScan 4.0 software lets you select a specific area of the page to be scanned. You cannot directly set the dots per inch of the scan, but you can set magnifications from the standard 75-dpi scan (from 50 percent to 300 percent) to change the resolution. The software checks the amount of memory required for the scan before it takes place; if not enough memory is present, the Thunder-Scan application will not allow the scan to proceed. This application also includes an editor that allows a FatBits level of picture editing and the use of the MacPaint-like lasso, select, pencil, eraser, and scrolling hand tools.

The scanner can store 32 levels of gray-scale information for the image in memory. You can also edit the gray scales of the scanned image with a gravlevel map editor and then save it to disk. You can save an image as a bit-mapped MacPaint document (up to a maximum of 32K bytes in size) or as a MacDraw PICT file; you can save the image's grayscale information as a ThunderScan file, an Encapsulated PostScript File (EPSF), or a TIFF file from within the Thunder-Scan application. TIFF files are saved in either a 1-bit "vanilla" format or a 4-bit compressed format. Due to the wide latitude that the TIFF specification allows in its implementation, ThunderScan TIFF files might not be compatible with certain applications, such as Zedcor Desk-Paint. However, PageMaker and Quark XPress accept the TIFF format.

Because of the nature of its scanning mechanism, the ThunderScan takes the longest of the devices tested to do a scan (see table 1). However, if you can spare



the time, ThunderScan gets you into the game inexpensively.

#### No Moving Parts: VisionScan

The next step up the scanning ladder is the VisionScan from Mirror Technology. The VisionScan unit is a Chinon flatbed scanner with no moving parts except for an internal mirror in the head (see photo above). It has a maximum resolution of 200 dpi. You place the image to be scanned on a flat base underneath an arm that extends up and over the base holding the image. The bottom of this overhead arm is clear, and it contains the charge-coupled device and optics that do the scanning. The image is illuminated by room light—the scanner adjusts for ambient level when you power it on. Depending on how a room is lit, the arm may cast a shadow on the document; it will show up as a darkening of the scanned image in the shadowed area. This happened to me during testing, and I found that supplemental fill lighting from a small high-intensity lamp is necessary for best results.

Like the ThunderScan, the flatbed scanner's data goes to either of the Mac's serial ports. An adapter cable provides the connection between the VisionScan's DB-25 serial port and the Mac's DIN-8 port. A Centronics-style parallel port is present on the scanner, but, at least with the setup I had, there's no software or cabling to make use of it. An external power supply plugs into a wall outlet, similar to the power supplies found on some calculators and modems.

You can set up this scanner pretty quickly. Place the scanner on a flat surface, and connect it to the Mac using the adapter cable. Next, connect the power cord to the scanner, and then plug the power supply into a wall outlet. Check the position of several DIP switches on the scanner, then turn the scanner on. Copy and install the software onto your start-up disk, and you're done.

You control scanning with either the VisionScan 1.0 application program or a supplied VisionScan desk accessory 1.0. Scans can be made at 100-, 120-, 150-, and 200-dpi resolutions. You can't edit the image from within either of these programs. Zedcor's DeskPaint DA 1.05, supplied with the VisionScan, is a fullfeatured editor that provides the necessary functions.

This scanner has three methods of determining what portion of the image is to continued

	ThunderScan	VisionScan	MSF-300C
Type	Imagewriter scanner	Flatbed scanner	SCSI flatbed scanner
Company	ThunderWare 21 Orinda Way Orinda, CA 94563 (415) 254-6581	Mirror Technology 2644 Patton Rd. Roseville, MN 55113 (612) 633-3255	Microtek Lab, Inc. 16901 South Western Ave. Gardenia, CA 90247 (800) 654-4160 (213) 321-2121
Features	300-dpi scanning cartridge with detachable adapter box; ThunderScan 4.0 software; user's guide; all necessary cabling; external drive PowerPort connector for use in connecting to Macintosh Plus or SE	200-dpi Chinon scanner; 15-V external power supply; VisionScan 1.0 software; user's guide; Zedcor's DeskPaint software; DB-25- to-Apple DIN-8 serial port connector	300-dpi MSF-300C scanner; interface box with 5-V power supply and tabletop mounting brackets; scanner-to-interface box connector; spare scanning lamp; VersaScan Plus 1.05 graphics software with user's guide; scanner-to-Apple DIN-8 connector for serial port use
Hardware Needed	Macintosh 512K, 512KE, Plus, SE, or II	Macintosh Plus, SE, or II	Macintosh 512KE, Plus, SE, or II; DB-25-to-50-pin SCSI converter cable (for Mac Plus, SE, or II)
Software Needed	System 3.2/Finder 5.3 or higher (System 4.2 or higher for Mac SE/II)	System 4.2/Finder 6.0 or higher	System 4.2/Finder 6.0 or higher
Options	Mac II power supply: \$49	None	None
Price	\$249	\$695	\$1595 Bundled with SCSI connector and cable: \$1795
	Inquiry 893.	Inquiry 894.	Inquiry 895.

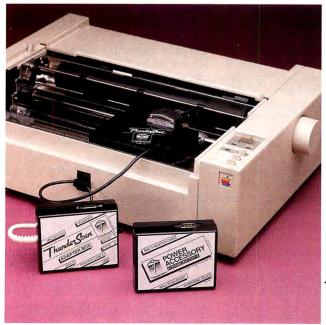
be scanned. As with most of the scanning software, you can specify the scan area with a click and drag of a rectangle outline over a template that represents the scanner bed. You can also scan the area of intersection determined by the position of adjustable horizontal and vertical sliders on the scanner base. This ends the need to measure an image to find where to set the scan, because you can specify it directly with the image itself. Or, you

can place the provided small v-shaped markers on the image itself. These markers indicate to the scanner the top right and bottom left corners of the image area you wish scanned. This is much more intuitive than having to select an area from within a application on a Mac screen.

You can save images as MacPaint (again, only to a 32K-byte file limit), PICT, Compressed TIFF (unrecognized by DeskPaint), Uncompressed TIFF

(recognized by DeskPaint), and Clipboard formats (to get around the 32Kbyte MacPaint limit but not the Clipboard's 1024-pixel width limit).

Scans at all dpi ranges from 100 to 200 dpi took about the same time, and the scanner was easy to use. The scannercontrol DA was a convenient and useful tool, and I could do most necessary touch-ups with the DeskPaint DA. The scanner was light enough to transport





**◆ Photo 1:** The ThunderScan (left) uses an Imagewriter or Imagewriter II print head.

Photo 2: The Datacopy Model 730 and SCSI adapter unit.

Model 730	MacScan
SCSI flatbed scanner	SCSI flatbed scanner
Datacopy Corp. 1215 Terra Bella Ave. Mountain View, CA 94043 (415) 965-7900	New Image Technology, Inc. 9701 Philadelphia Court Lanham, MD 20706 (301) 731-2000
300-dpi Model 730 flatbed scanner with AC power cord; installation and maintenance guide; SCSI unit needing no external power supply; scanner-to-SCSI unit connectors; MacImage 2.01 graphics software with user's guide	300-dpi Canon IX-12 scanner; AC power cord; SCSI unit with external 5-V power supply; scanner-to-interface unit cable; Mac SCSI port-to-interface unit cable; MacScan 1.38 software; instruction manual
Macintosh Plus, SE, or II; DB-25-to- 50-pin SCSI converter cable	Macintosh Plus, SE, or II
System 4.2/Finder 6.0 or higher	System 4.2/Finder 6.0 or higher
MacImage Kit with SCSI connector: \$695	Textscan OCR software: \$395
\$1800 Bundled with MacImage Kit: \$2495	\$1995
Inquiry 896.	Inquiry 897.

easily and was compact enough to fit well on my cluttered desk. The only potentially serious flaw I found was the need to provide supplemental lighting so the overhead arm would not cast a shadow.

It is harder to scan a book on this scanner than on the flatbed ones because there's no easy way to hold the book flat. The scan output may be distorted over the bowed surface. However, single flat sheets scan rather nicely.

#### Short a Cable: The MSF-300C

The first SCSI flatbed scanner I evaluated was the Microtek MSF-300C. It consists of the flatbed scanning unit itself, an interface unit, an adapter cable to connect the scanner to the interface unit, a brick-size power supply for the interface unit, and the VersaScan Plus 1.05 software for the Mac. [Editor's note: As we went to press, Microtek introduced its MSF-300Q scanner, which can record 64 gray levels. It costs \$2495.]

The Microtek interface unit is a wide metal box that comes with support brackets used to mount it vertically on the desk next to the scanner. This unit sits electrically between the scanner and the Mac's SCSI port. The unit has a single DB-25 connector for the scanner cable, and two 50-pin SCSI connectors. The two SCSI connectors let you daisy chain other SCSI devices or use a SCSI terminator block to terminate the bus. A relatively thick DB-25-to-DB-25 cable connects the unit to

the scanner. The scanner itself is a flat, bulky metal box with its own power cord and switch.

Right away, while hooking up the scanner, I ran into a problem: A needed cable was not supplied with the unit. This cable, made by Apple, converts a 50-pin standard SCSI socket to Apple's DB-25 SCSI connector. Unfortunately, the cable is not standard issue from Apple. You must order it, and Microtek assumes you already own one. You'll save yourself some embarrassment if you have this cable handy when the box comes.

The VersaScan Plus 1.05 application that comes with the scanner will be familiar to anyone who has used similar software with AST Research scanners. It combines paint-like tools for editing a scanned image and the control functions necessary to operate the scanner. A dialog box lets you set the scan's resolution (75, 100, 150, 180, 200, or 300 dpi) and the area of the image to be digitized. The dialog box also displays the amount of memory available for a scan. You can even bypass the SCSI port and communicate with the scanner at 9600, 19,200, or 57,600 bits per second through the Mac's serial port. This feature should be of use to 512KE Mac users whose machine lacks a SCSI port.

The time to scan an image was the same (14 seconds) regardless of the format I saved it in. (Available formats include the VersaScan native format,

Table 1: The scanners compared. I scanned an 8- by 6-inch image at 150 dpi and noted the elapsed time. The image was saved as a 1-bit-per-pixel TIFF file. Times are in minutes; seconds.

	Time	File size (K bytes)
ThunderScan	25:37	117
VisionScan	1:14	192
MSF-300C	0:14	501
Model 730	0:15	249
MacScan	0:12	122
madodan	0.12	122

MacPaint, TIFF, gray TIFF, PostScript, and gray PostScript). As long as you have sufficient RAM to store the image, you can edit it right away. I ran VersaScan under MultiFinder with other applications taking up available RAM to simulate out-of-memory conditions, and the error handling was graceful, without loss of work. The TIFF files the MSF-300C saved, though, were huge compared to those saved at the same dpi by the other scanners. I can find no reason for these excessive file sizes.

#### Slick Hardware, Mediocre Software: Datacopy Model 730

The Datacopy scanner package consists of a flatbed scanner (I looked at the Model 730), a small SCSI unit, an adapter cable to connect the interface unit to the scanner, and the MacImage 2.01 software. The Datacopy is the only SCSI scanner whose interface box did not require an external 5-V power supply; its installation was much neater, without excess cabling. The front panel of the scanner, with its scanner status lights, has a slick "instrument" look to it.

Setup is fairly quick and simple. However, I ran into the same problem I had with the Microtek scanner: a missing SCSI adapter cable. To be fair, Datacopy's SCSI adapter kit does include a DB-50-to-DB-50 SCSI cable that you can hook to an external SCSI hard disk with a second SCSI connector. However, if you own a Mac SE or Mac II with an internal hard disk, you need that Apple adapter cable.

The supplied MacImage 2.01 application, like the scanner, had some nice touches. The image setup dialog box uses pop-up menus for selecting scanning parameters. You can scan images at resolutions of 75, 100, 120, 150, 180, 200, 240, and 300 dpi and with 16 gray levels. The application has excellent control

continued



Figure 1: (a) BYTE's test pattern for scanner quality. (b) The test pattern scanned at 150 dpi. The Microtek scanner was adjusted for halftone scanning to accommodate the halftone image. When the scanner was adjusted for line art, the lines and patterns looked considerably better, but the halftone's quality suffered. (c) The test pattern scanned at 300 dpi, halftone setting. Notice the improvement in the lines and patterns as well as in the halftone image. All images are actual size.

functions, such as a halftone data editor that allows use of custom halftone patterns, and a gamma value editor that lets you use custom gray levels. A rich variety of useful formats is available for storing images, including scaled and clipped MacPaint, a proprietary Datacopy format (compressed and uncompressed), compressed and uncompressed TIFF, PICT, PostScript, EPSF, Raster Image File Format (used by Image Studio), and SuperPaint.

Another useful and unique feature of the software is the Auto-Configure command. This allows the system to find the correct SCSI address of the scanner, as well as confirm the hardware model used, since the MacImage application is designed to run with several models of Datacopy scanners. Highly useful for the novice, it eliminates the possibility of setting the SCSI address to the wrong value.

Still, the software needs to be revised. After completing a 300-dpi scan in 15 seconds, the MacImage program took almost 5 minutes to spool the 994K-byte uncompressed TIFF file to disk and return control to the user. Once the image was available on-screen, the only editing tool available was a FatBits pencil. Loading and converting files not saved in the Datacopy format also takes too long, compared to other programs doing the same thing. These waits, and the lack of a suitable image editor, mar an otherwise nicely done product.

#### No Complaint: MacScan

New Image Technology's MacScan uses the Canon IX-12 flatbed scanner, which is also sold as the Princeton Graphic Systems' LS-300F. The MacScan did not need any additional SCSI cables. The supplied ribbon cable connects the Mac's DB-25 SCSI port to the DB-25 SCSI connector on the scanner's interface unit. The cable also has an extra connector so that it can be connected as male-to-female or male-to-male. It is so handy for connecting Mac SCSI devices in general that I may forget to pack it back into the box when I return the unit. The interface unit requires an external power supply.

The supplied MacScan 1.21 software (the company says the version now being shipped is 1.38) did a good job of controlling and editing scans. You set the scan region by clicking and dragging on a template on the Mac's screen. Many MacPaint-like tools are available for editing, and the image is loaded into memory rather than spooled to disk. You can select, manipulate, print, and save subareas of the image separately from the

main image. A full-page scan took 12 seconds regardless of the resolution (75, 150, 200, or 300 dpi) of the scan. You can save files as TIFF (uncompressed, compressed, and gray-scale), EPSF (standard or Macintosh format), Mac-Paint, SuperPaint, PICT, and Page-Maker 1.2 formats. Gray-scale information is limited to 4 bits (16 levels) and can only be saved in the TIFF format.

I liked this unit best of all the SCSI scanners because the hardware occupied the smallest volume and because the software is loaded with features. It also gave the best results at 300 dpi.

#### Reading What's Scanned: OCR

I used Read-It! 1.06 by Olduvai Software to do some OCR tests. This application can drive the Microtek scanners or MacScan and can even read a bit-mapped image to extract character information as ASCII text. It costs \$395 for any scanner but ThunderScan (this version costs \$149). Olduvai also supplies type tables containing 200-dpi information that allows the application to make character decisions with the data. I tried Read-It! with two of the five scanners: the Mirror Technology VisionScan, because of its aggressive price/performance ratio, and the New Image MacScan, because Read-It! can control the MacScan unit.

I had Read-It! load a type table very similar to the type of the document I was using. Since the application learns from its mistakes, I went through one recognize/learn cycle with it to make sure that my type choice was reasonable.

The VisionScan produced good results on the first pass: Only 3 out of 880 characters were not recognized. The Mac-Scan worked well at 200 dpi, but the performance with the program's supplied 200-dpi type tables degraded significantly when I did a 300-dpi scan. The increased sensitivity of the 300-dpi scan introduced errors in recognition.

#### What Scanning Is Worth

All the scanners produced good results. Scanning at a higher resolution improves the overall image, but since the Mac display is limited to 75 dpi, the images look the same on the screen. Where the higher resolution pays off is when you print the image to a device that can support it (see figures 1b and 1c). Of course, higher-resolution scans require more memory and more disk space.

If it were my money, I'd buy the Mirror Technology VisionScan. Its price/ performance ratio is unequaled. Performance was fine for my personal use. It's smaller than the other units, and setup is fast. Since it uses the serial port, turning the Mac off is not necessary, as it is when connecting a device to the Mac SCSI port. I also liked the flexibility of having the scanner software as a DA. It made the scanner available whenever I wanted it, without the need to launch a separate control program.

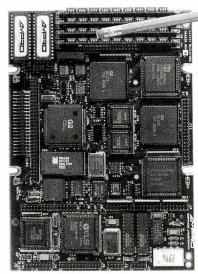
But if you need 300-dpi resolution for LaserWriter output, I recommend the New Image MacScan. The hardware and software are complete, the \$1995 price is

reasonable for a SCSI flatbed scanner, and the company promises a gray-level upgrade for those who need it by the time this article sees print. Your scanner will not be obsolete should you wish to upgrade.

Laurence H. Loeb is an electrical-engineer-turned-dental-surgeon in Wallingford, Connecticut. He is comoderator of the macintosh conference on BIX. He can be reached on BIX as "lloeb."

### **WHY DESIGN YOUR PRODUCT AROUND A COMPUTER?**

Design the computer in.



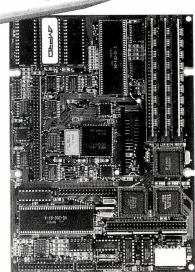
#### Little Board™/286

Built-in vs. built-around. External systems mean boxes, boards, backplanes, cables, and reliability problems. Ampro's Little Boards give you a complete system on a single board you can build right into your product.

Small size. Big power. Eliminate the bulk and constraints of multi-board, backplane-based systems. Embed a Little Board that requires just 2/3rds the power and volume of a 5\"/4" floppy drive. But with the full power of a PC or AT®.

Fully compatible. Little Board/286 and Little Board/PC are functionally identical to multi-board PCs and ATs. They run PĆ-DOS™ 2.0 to 3.X. They run DOS languages, compilers and applications. You'll be standing on a proven foundation of hardware and software

**Ampro's Single Board Systems.** It's all there. Up to a Megabyte of RAM. RS-232C and Parallel ports. AT/PC-compatible controllers and bus expansion. EGA/CGA/MDA and Hercules™-compatible video



#### Little Board/PC

options. Even optional solid-state disk. Plus SCSI support for hard disk, tape, optical drives, bubble drives ... you name it. And, low power consumption (+5VDC, less than 8W) and a wide operating temperature range (0 to 60°C). Perfect for standalone operation and harsh environments. Anywhere that reliability is a critical consideration.

Available worldwide. For information and the name of your nearest U.S. or international Ampro representative, call us at the number below. Or write for Little Board Product information.

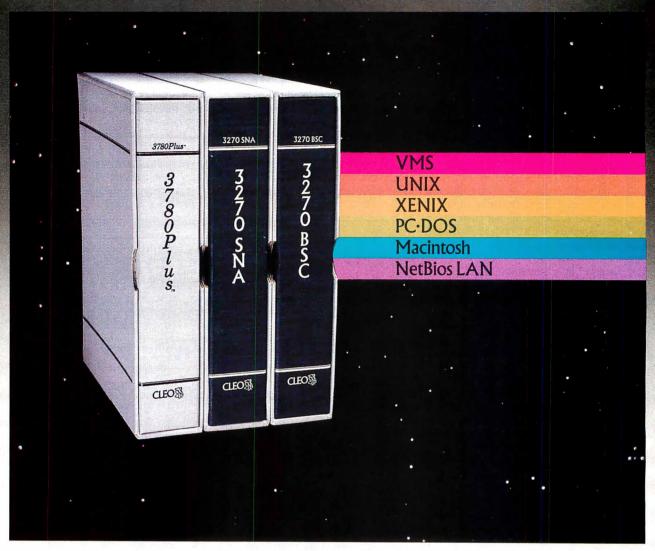
408-734-2800

OMPUTERS, INCORPORATED 1130 Mountain View/Alviso Road Sunnyvale, CA 94089

Reps: Australia—61 3 720-3298; Austria—43-222/45 45 01; Canada—(604) 438-0028; Denmark—45 3 66 20 20; Finland—358 0 585-322; France—5 4502-1800; Germany, West—45 89 611-6151; Israel—972 3 49-16-95; Italy—39 6 811-9406; Japan—81 3 257-2530; Metherlands 10-04-116 820; Spain—M43 290-2209; Sweed—46 855-05-05; Switzeriand—11 1740-41-05; United Kingdom—44 2964-35511; USA—contact AMPRO

Trademarks: IBM, AT-IBM Corp.; Hercules-Hercules Computer Technology, Inc.; MS-DOS-Microsoft Corp.; LittleBoard - Ampro Computers, Inc.

## CLEO is your SNA, BSC and Coax Gateway



#### **Sharing Information**

Whatever your industry, your computers need to share information with your mainframe. Or, they need to exchange data with other computers. In either case, you need a total communications solution. You need software, hardware interfaces and modems that all work together smoothly. You need CLEO!

CLEO software products allow your computer to communicate with minicomputers and mainframes, and to emulate their workstations. Since 1981, CLEO has provided communications between micros, minis, and mainframes for the automotive, insurance, medical and banking industries. Today over 78,000 CLEO users worldwide are running on all major computer brands. The greatest number of these users run CLEO software on IBM Personal Computers and NETBIOS LANs.

#### Complete Software/Hardware Package

Every CLEO package contains all the software and hardware accessories you'll need. Your selected CLEO SNA, BSC, or Coax software is packaged with 1) an internal modem card for dial-up applications, or 2) an interface card and cable for use with your existing modem, or 3) a Coax card for local connectivity. There's no waiting for non-CLEO add-ons. And, you get prompt, single-

Package prices range from \$795.00 for most stand-alone packages, up to

for most stand-alone packages, up to \$1,995.00 for the 32-user SNA gateway.

Call us today to discuss your application.

CLEO Software 1639 North Alpine Rd. Rockford, IL 61107 Telex 703639 FAX 815/397-6535

#### Headquarters:

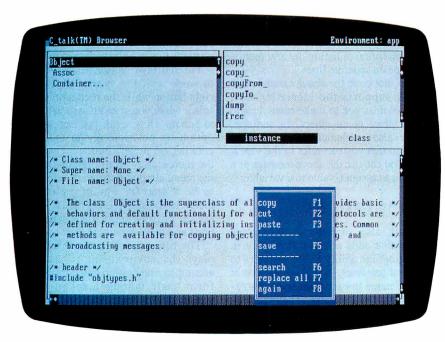
USA: **1-800/233-2536** Illinois: 1-800/422-2536 International: 815/397-8110

Sales and Distribution:
Benelux: 31 (0) 33-948888
Canada, East: 800/361-3185
Canada, West: 800/361-1210
Canada, Montreal: 514/737-3631
Colombia, S.A.: 12172266
Denmark: 02 94 81 19
England: (0993) 776543
France: 146861136
Italy: (0331) 634 562
Mexico City: 596-5539
Sweden: 468311780





## Smalltalk à la C



C\_talk provides object extensions to C in a Smalltalk-like environment

Namir Clement Shammas

evelopers who program in C are always in need of a better way to handle objects. C\_talk 1.0, an object-oriented language from CNS, may be the answer. It gives the C programmer object-oriented programming and a Smalltalk-like environment. C\_talk extends the C language with elements of an object-oriented language, such as classes, objects, methods, messages, inheritance, and dynamic

bonding. And, in certain respects, C\_talk rivals C++.

For data, C\_talk implements classes and methods. The identifier id is used to define any object class. The C declaration of id is

typedef long id;

The id type is used to store the memory address for the definition of an object class.

Also available are both class and instance variables. Class variables are shared by all the instances of that class. Instance variables are the private variables (or record fields, if you like) associated with each instance of the object class. Every time an instance (equivalent to a variable in structured languages) is created, a new set of instance variables are also allocated. By contrast, only one set of class variables exists at any time.

C\_talk comes with a set of defined "foundation classes," with the "object"

class as the parent of all classes. The foundation classes include the popular data structures, such as Buffer, Stream, ByteArray, Collection, and so forth. You can inspect and even alter the C\_talk code for any of these methods.

The second object-oriented aspect that C\_talk supports is inheritance. Inheritance is a powerful aspect of object-oriented programming that lets you bypass having to rewrite similar code for every new subclass. This means that both the class and instance methods of a class object are automatically inherited by all subclasses. C\_talk supports linear inheritance, where a subclass can inherit from only one parent class (also called a superclass). You can override inherited methods by simply defining new ones with the same name for a subclass.

The third object-oriented component of C\_talk is messaging that activates various objects and lets them interact with other objects. Here C\_talk introduces its own new syntax. A C\_talk message, like that of Smalltalk, is made up of a receiver (i.e., the object receiving the message), the selector (which is very similar to a function or procedure in structured languages), and optional arguments. The general syntax for a C\_talk message is

@receiver selector < list of optional arguments>@;

Receivers can be either classes or instances. The most frequently used messages associated with classes are those that create new instances, such as

id CalculatorStack; /\* assign id to instance \*/

@Stack new\_ &CalculatorStack@;

This example informs the stack object class to invoke the new\_ selector and create a new stack. CalculatorStack points to the dynamically allocated in-

#### C\_talk 1.0

#### Type

Object-oriented language

#### Company

CNS, Inc. Software Products Dept. 7090 Shady Oak Rd. Eden Prairie, MN 55344 (612) 944-0170

#### **Format**

Two 51/4-inch floppy disks

#### **Hardware Needed**

IBM PC or compatible with 512K bytes of RAM and a hard disk drive; a mouse is recommended

#### Software Needed

Microsoft C, Turbo C, Lattice C, or C86

#### Language

C

#### **Documentation**

152-page user's manual

#### Price

\$149.95

Inquiry 892.

stance of Stack. All instances of object classes are declared dynamically. Once created, the instances of the classes can receive their own messages to store, recall, and manipulate data. For example, the following message clears the contents of the stack CalculatorStack:

@CalculatorStack clear@;

Or a message could push a new value in the stack:

@CalculatorStack push\_
newValue@;

Messages in C\_talk have optional arguments. C\_talk employs a scheme where each argument is preceded by a keyword. A keyword is an identifier ending with an underscore. The complete name of the selector is the concatenation of all the keywords involved. For example,

@room putLen\_ len width\_ wide
 height\_ high@;

assigns the three dimensions of a room object. The selector is putLen\_width\_height\_, and the arguments are len, wide, and high.

And like C functions, C\_talk permits messages to return data:

```
getVolume
/* get the volume of a room
   assuming that room has the
   following instance variables:
   double length, width, height;

*/
{
  return (self->length * self->width
  * self->height);
}
```

C\_talk does not require you to define a data type for the message. You must, however, type message arguments. The manual suggests the Kernighan and Ritchie convention of listing the arguments' data type on separate lines.

Also, notice in the above example that C\_talk supports the identifier self, which enables you to make references to the variables of an object. In addition, C\_talk also implements the identifier super so that you can refer to the superclass. You can use the above message as a function to assign a value to a variable:

volume = @room getVolume@;

C\_talk also supports an interesting feature that adds a lot of flexibility in messaging: the ability to use variables to represent selectors. You place the actual selector name in backward single quotes and assign it to a variable. Then the variable is used in the message:

```
int selector;
...
selector = 'getVolume';
....
volume = @room selector@;
```

Generally, I found the object-oriented syntax and constructs of C\_talk easy to learn. However, I recommend that most C programmers become familiar with the rules of object-oriented languages first and then begin using C\_talk. The learning effort for C\_talk is far less than that for, say, Smalltalk. Getting into the world of object-oriented programming is made even easier with the C\_talk environment (see the text box "Object-Oriented Programming Basics" on page 203).

#### The C\_talk Environment

There are three main components that make up C\_talk's package: the browser, the preprocessor, and the make utility. The C\_talk browser manages the window-based environment that you use to

enter, view, and edit C\_talk applications. The C\_talk preprocessor converts C\_talk files, which contain hybrid C and C\_talk code, into pure C source code. You use the C\_talk make utility to intelligently preprocess and compile updated files and then relink the application's object code files. It yields applications compiled with either Microsoft C, Turbo C, Lattice C, or C86.

The C\_talk browser brings a slick Smalltalk-like environment to C programmers. Using a mouse is highly recommended, but it is not mandatory. The browser contains five windows, of which three can display scrollable information. The windows consist of the following: title, classes, method type, methods, and contents (a text editor window).

I used the two-button Microsoft Mouse to work with the system. Pressing the right button while the rectangular cursor is in a window causes an associated menu to pop up. In general, you can select any option by positioning the mouse and clicking on its left button. If you move the mouse away from the pop-up menu, the menu simply disappears. I found this to be a graceful way of removing the menu. In the absence of a mouse, you can use the cursor-control keys to select options and move around in the browser.

The title window in the browser displays the environment filename. Its accompanying pop-up menu lets you perform basic management of the environment: exiting, invoking the DOS shell, invoking a DOS command, editing a file, setting up the Make specification, and saving the entire contents of the environment.

The Make setup option leads to another pop-up window. The latter window permits you to specify the C compiler's command line, a list of auxiliary files in use, the linker's command line, and the list of .OBJ and .LIB files to be included in the linking process. You can easily examine and alter these specifications outside the C\_talk browser by using a text editor to edit the environment file.

The classes window displays the various class identifiers that are associated with the environment examined by the browser. To illustrate how classes inherit properties from their superclasses, the browser displays classes indented according to the inheritance level. Beyond a certain level, classes are not initially displayed. You can use an option in the associated pop-up menu to display the invisible classes. This is helpful when concentrating on a particular subtree of classes. Other options in the class menu let you load, save, delete, swap, and add

#### Object-Oriented **Programming Basics**

bject-oriented languages work by issuing commands to data objects, telling them to perform certain procedures or functions. For example, to calculate the square root of a number in an object-oriented language (OOL), you must send a message to the object (in this case, the number) telling it to return its square root. The general syntax is

object selector [arguments]

The selector is the method invoked and is equivalent to a procedure or function in structured languages. An OOL has a set of methods (i.e., routines) that are declared to work with it. Thus, an OOL combines the what (the object) with the how (the method).

An important departure from traditional structured programming in an OOL is the way the data types are handled. In object-oriented milieus, data types are called classes and are also considered to be objects. While this may seem very odd for veterans of structured languages, classes have their own methods that, for example, empower the creation of dynamically allocated variables, called instances. Instances are also objects with their own set of methods and hidden data structures. Accessing the data structure of an instance requires methods that authorize you to do so. Also, methods can permit access to specific parts of an instance. Thus, object-oriented programming fosters data hiding to implement robust software applications.

Inheritance is a powerful concept used by OOLs based on the ability to define subclasses derived from parent classes. Subclasses are able to automatically inherit the data structures and methods of the parent classes. Consequently, less coding is needed if the inherited method is valid for a subclass. But a subclass can also define its own data structure (i.e., add to the inherited structure) or its own methods. Linear inheritance is the typical scheme of inheritance where a subclass inherits from a single-parent class. Some OOLs implement nonlinear inheritance, which allows a subclass to inherit from two or more parent classes.

The hierarchy of classes has an interesting impact on message handling. When an object receives a message, the message is first searched in the catalog of methods directly associated with that object. If none matches the incoming message, the methods of the parent class are searched, and so on. The search either finds a matching method along the path of ancestor classes or fails.

classes. Since C\_talk maintains the exact hierarchy of classes, loading a deeply nested class causes the program to load all its superclasses not already in the browser. When you select a class, the contents window displays the substance of the header file (in C) associated with

The appealing part of the C\_talk environment is that it lets you access the information related to a class. The method types window permits you to select properties that are related to either a class or an instance. When either is selected, the C\_talk environment automatically updates the methods and contents windows. Initially, these windows reveal variables and methods related to the selected class or its instance. When a method is selected, the contents window then displays the detailed listing of that method.

Since the contents window is a text

editor, you can modify the method of a class, the method of an instance, the variables of a class, or the variables of an instance. The contents window's pop-up menu supports copying, cutting, and pasting text; saving the substance of the contents window; and performing text search or translation. When using a mouse, the contents window displays both an underscore text cursor and a mouse block-type cursor. I found that editing text was confusing when the system shifted from the text cursor to the mouse cursor. Backspacing and moving the cursor often required me to click on the mouse or press the Insert key to reposition the text cursor.

#### **Processing Files**

The C\_talk application environment is stored into an ASCII text file with an continued

#### Subscription Problems?



#### We want to help!

If you have a problem with your BYTE subscription, write us with the details. We'll do our best to set it right. But we must have the name, address, and zip of the subscription (new and old address, if it's a change of address). If the problem involves a payment, be sure to include copies of the credit card statement, or front and back of cancelled checks. Include a "business hours" phone number if possible.

#### RVTE

Subscriber Service P.O. Box 7643 Teaneck, NJ 07666-9866



.ENV extension name. The default environment filename is APP.ENV, and it contains a list of the object classes, followed by a list of auxiliary C files. Any related .OBJ or .LIB files are listed next, followed by the sequence of commands to invoke the C compiler and the linker. Thus, you can edit .ENV files with text editors to alter the compiler and linker sequences. Originally, APP.ENV contained commands to invoke the Microsoft C 4.0 compiler. I edited the .ENV file

to invoke the Microsoft C 5.1 compiler installed on my hard disk drive.

Each application should reside in a separate DOS directory. Each object class in an application is stored in a separate text file with the .PRE extension name. These .PRE files contain all the information relevant to a class. The C\_talk browser uses an exclamation character as a special delimiter, allowing it to parse the various declarations when reading a .PRE file. You can alter a .PRE file with

your favorite text editor provided that you do not tamper with exclamation characters.

The C\_talk preprocessor is a utility that you invoke separately from the DOS command line. You can invoke the preprocessor for any object class without going through an entire sequence of checking related superclasses. The C\_talk preprocessor reads a .PRE file and yields a .C file containing C code. The preprocessor is able to detect inconsistencies and flags them for additional editing.

You also invoke the C\_talk make utility as a separate program from DOS. The make utility's role is to invoke the C\_talk preprocessor, C compiler, and linker. Only the .PRE files that belong to updated object classes are run through the preprocessor. The corresponding C files and all altered auxiliary C files are recompiled, and the linker is invoked to relink the entire set of object files.

Writing a C\_talk application is relatively easy, though there are a few rules to watch out for. The first is that the main() function should be placed after a dummy method, using the following general method:

main/\* dummy C\_talk method \*/
{
}
main()/\* the actual main function \*/
{
<declarations>
\_init\_classes();
<other code lines, I/O, etc.>
}

In addition, the main() function must include a call to the \_init\_classes() function, found in the file CLASSES.C. The C\_talk browser updates CLASSES.C to include the declaration of new object classes and calls to initialize them. If CLASSES.C is not properly updated, you may get a linker-error message, putting a halt to the production of the application's executable file.

Overall, C\_talk provides a very practical and smart route to object-oriented programming. Its Smalltalk-like environment is easy to use, and its object-oriented extensions to C are powerful. Clearly, C\_talk is a worth-while product for any programmer interested in getting into object-oriented programming.

Namir Clement Shammas is a columnist for several computer magazines and a freelance writer living in Glen Allen, Virginia. He can be reached on BIX as "nshammas."

## C\_talk The Practical Union of C and Smalltalk

#### Add a new dimension to your C compiler.

#### From C:

- Ease of application delivery portability
- Performance speed and efficiency of C
- Familiarity of C use all your existing C code

#### From Smalltalk:

- Data abstraction data hiding/encapsulation
- Full object inheritance
- Polymorphism message sending with dynamic binding

Boost Your Productivity! C\_talk's practical approach to object-oriented programming in C allows you to realize substantial productivity gains using these tools:

 C\_talk's Browser - a powerful Smalltalk-like browser for building software objects

- An automatic Make utility for building applications
- A Preprocessor for converting objects into C source code.
- A set of Foundation Classes to use as basic building blocks.



\$149<sup>95</sup>

#### Why C\_talk?

C\_talk has been proven successful in delivering several large-scale systems in demanding realtime environments. It's concise, easy to learn and use. It is programming in C (not a new language), while adhering to the Smalltalk paradigm.

C\_talk is the practical, and affordable, union.

C\_\_talk is designed to operate with MSDOS on IBM or compatible computers. At least 512K of memory, a hard disk and mouse are recommended.

#### Order today!

Call or write: CNS, Inc. Software Products Dept. 700 Shady Oak Rd. Eden Prairie, MN 55344 Tel: (612) 944-0170 Fax: (612) 944-0923

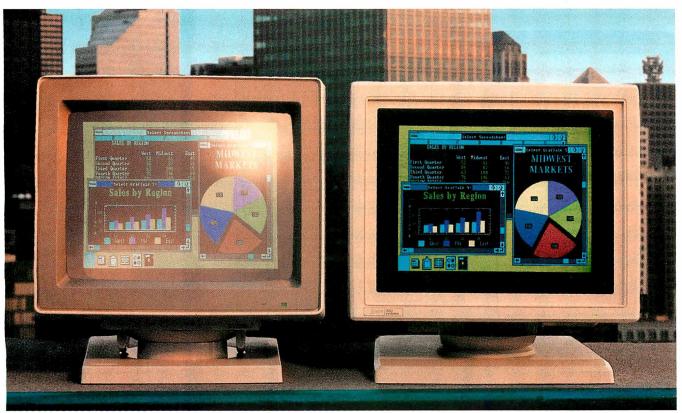
Add for shipping \$5 US, \$25 Int'l. (30-day money-back guarantee)



... providing and advancing object-oriented methodology.

C\_talk is a trademark of CNS

CNS is a registered trademark of CNS, Inc.



Unretouched Screen Images

## Buy The One On The Left And You'll Have To Put It Where The Sun Don't Shine.



The monitor on the right, however, can be placed anywhere you like. Even in direct sunlight. It's the new *Flat Technology Monitor* from Zenith Data Systems—winner of *PC* 

*Magazine's* coveted "Technical Excellence Award" in the hardware category for 1987.

#### You Have To See Zenith To Believe It

So clear. So precise. So lifelike. It's the only monitor with a completely flat screen. A breakthrough that has redefined monitor quality forever. Industry experts are already convinced. And once you see it in person, you'll be a believer, too.

#### Bigger, Brighter, Glare-Free

Our Flat Technology Monitor has an impressive 14 - inch display. And even though it's bigger, it's 50% brighter than conventional CRT's and it has 70% greater contrast. So you get colors with greater depth and definition that make your reports, charts and graphs come alive like never before.

The Flat Technology Monitor is virtually glare-free. So you can work longer without the usual headaches

and eyestrain. And that means greater productivity. But to get the whole picture, you have to see it with your own eyes.

#### **Backward And Forward Compatibility**

You also get full compatibility with the high resolution VGA Video generated by IBM's new PS/2\* computers. And with Zenith's Z-449 or other VGA-class video cards, you can enjoy CGA, MDA, Hercules and EGA graphics as well.

#### **Experience Zenith's Latest Technology Breakthrough**

Obviously, a mere picture can't do justice to our new Flat Technology Monitor. It demands a face-to-face evaluation. For a hands-on demonstration, call today for the name of your nearest authorized Zenith Data Systems dealer—the Flat Technology Monitor is available in quantities right now.

1-800-553-0305

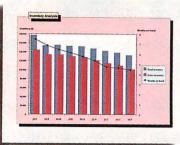


THE QUALITY GOES IN BEFORE THE NAME GOES ON®

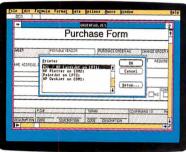
© 1988, Zenith Data Systems

Personal System/2 and PS/2 are registered trademarks of IBM Corp.





Don't waste any more time, or paper. Preview your ideas before you print them out.



As you can see, Microsoft can make all kinds of HP printers and plotters look their best.



Personalize your LaserJet Series II Printer with HP fonts and memory boards.

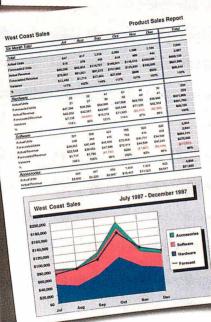
These documents were brought to you by Microsoft Excel, Microsoft Windows, and the HP LaserJet Series II, PaintJet and DeskJet printers.

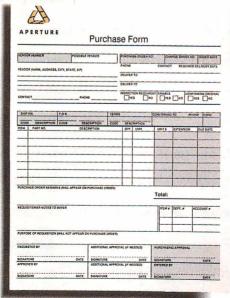


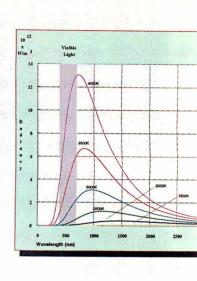
#### Personal Stock Portfolio

Business Address:	Larry S. Stevens 1234 Cherry St. Coventry, WA 98666 (206) 555-2000		Dote: 5 Home Address: 2 C Telephone: (	713 Elm Blvd. oventry, WA 9866
Stock	Symbol	NO CHILD	Close	ENGLISHED IN
		5/23/88	5/24/88	5/25/85
Enchantment Lakes	EL	75,250	75.750	76,125
Trey Research	TŘ	48.625	48,175	46,875
Trans-Com	TCM	33.875	33,750	34.250
Maser Software	MSW	58,500	58,000	58.675
WaveWorks	ww	64,750	64.625	65,375
Valuation	The Late of the	\$23,856.88	\$24,771.38	\$26,883.88
Stock		Holdings	Current Ovote	Current Value
Enchantment Lakes		100	76.125	\$7,617.50
Trey Research		125	48.875	\$6,109.38
Trans-Com		120	34,250	\$4,110.00
Maser Software		15	58.675	\$850.13
WaveWorks		125	65.375	\$8,171.88
		-	Portfolio Total:	\$26,883.88

uite 201, Olympus Building • 123 West Fifth Avenue, Miami FL 33186 • (305) 273-2839









#### West Coast Sales

#### Consolidated Balance Statement

ssets					
Current A	acets				
Cash I	and Sto	n-term	Investm	cots	
Acrou	nts Rec	civable			
Invent	ories				
Other					
Te	sal Cun	ent Au	rts		
Property.	Plant, a	nd Esqu	ipment		
Other Ass	465				
OTAL ASSI	:73				

#### Liabilities and Stockholder's Equity



Capital Lease Obligations
Commitments and Contingencies
Total Liabilities
Stockholde's Equity
Common Stock
Pail in Capital
Retained Farmings

\$2,014 \$1,000 \$3,468 \$4,727 \$57,477 (6650) \$59 \$31 \$70,654 \$59,350 \$165,265 \$155,000 \$1,245 \$991 \$246,200 \$11,545

Radioactive Deca



\$12.969 \$8.621 \$7,095 \$5,933 \$27,914 \$6,079 \$5,843 \$4,722 \$2,579 \$2,517 \$1,594 \$1,130	1980 48,107 25,446 53,393 5903
1984 1983 1982 1983 575,988 864,299 553,256 549,441 5 512,989 58,621 17,095 25,033 17,914 56,079 25,043 54,722 17,914 56,079 25,043 54,722 12,259 52,517 51,251 51,351	1980 48,107 25,446 53,393 5903
\$15,000 \$44,299 \$53,255 \$49,441 \$ \$12,000 \$8,621 \$17,000 \$55,003 \$77,91 \$4,079 \$5,043 \$4,722 \$2,525 \$5,517 \$1,000 \$1,100	48,107 \$5,416 \$3,593 \$905
\$12.969 \$8.621 \$7,095 \$5,933 \$27,914 \$6,079 \$5,843 \$4,722 \$2,579 \$2,517 \$1,594 \$1,130	\$14,22 \$2,593 \$3,593
\$7,814 \$4,679 \$3,843 \$4,722 \$2,579 \$2,517 \$1,591 \$1,130	\$3,593 \$905
32,579 \$2,517 \$1,591 \$1,150	\$905
DWI 770 \$31.516 \$67.789 \$61.326 \$	
	35(03)
\$26,158 \$18,004 \$17,945 \$16,3% \$	14,733
\$2,743 \$1,880 \$1,747 \$1,501	\$782
erior section school states s	TEMP
\$11,068 \$24,911 \$22,555 \$26,760 \$	31,200
	11,334
\$2,171 \$1,869 \$1,605 \$1,173	1202
\$2,406 \$2,240 \$1,837 \$1,621	\$1,002
\$1,754 \$1,136 \$1,068 \$1,051	3611
2675 2591 3432 5403	\$155
\$2,391 \$2,319 \$1,538 \$1,399	\$792
istui tifai man aileo t	WW.
M70 1109 1414 1317	3313
\$2,191 \$2,156 \$1,458 \$1,458	\$1,673
e estime traine made andre	Lm 27/
218 218 216 212	\$11
	\$7,933
	135,661
\$626 \$541 \$177 \$297	1507
	10.197
1777,674 SML 149 357,485 374,911 1	



# Two world leaders osive măterial

Hewlett-Packard and Microsoft just took the simple act of communication and turned it into some-

Microsoft Excel

thing a bit more powerful.

Illumination. Because to us, anything worth presenting in a spreadsheet

is worth presenting more clearly, more concisely, and more forcefully. Which is exactly what Microsoft® Excel and the Hewlett-Packard® LaserJet Series II® printer let you do.

With this powerful combination of software and printer, now it's easier to take common data and make it look anything but common. With incredibly flexible font styles, font sizes, borders and shading. Incorporated into spreadsheets, charts, tables and forms that instantly make your data say more. Your numbers add up to more. Your

facts, figures and ideas mean more.

And of course, HP® desktop plotters and printers, from the ColorPro® plotter to the PaintJet® DeskJet<sup>™</sup> and LaserJet Series II printers, can unleash the potential power inside every box of Microsoft Excel. And vice versa.

To witness a whole new world of spreadsheet output, call us at (800) 541-1261, Dept. I56 for a free copy of our booklet, "Of Power And Printers." Or simply go to your dealer. And see firsthand what happens when two explosive elements get together.

And the chemistry's just right.



HP LaserJet Series II Printer

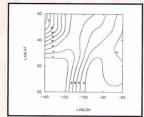
#### *Microso*

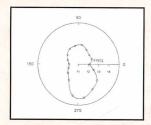
© 1988 Microsoft Corporation. Microsoft and the Microsoft logo are registered trademarks of the Microsoft Corporation. Hewlett-Packard, ColorPro, PaintJet and LaserJet Series II are registered trademarks, and Desk Jet is a trademark of Hewlett-Packard Company. Customers in Canada call 1-416-673-9811, outside of North America, 1-206-882-8661. Offer good in United States only

# Systat. Because other statistics and graphics packages are not enough.

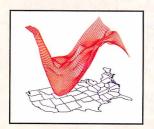
**Systat** now offers more statistical graphics than any other PC or mainframe package. And we still give you less bulk with more statistics.

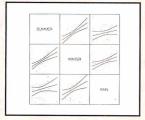


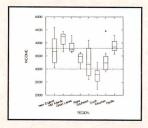


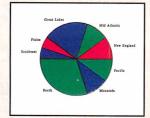


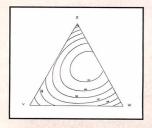


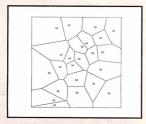


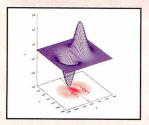


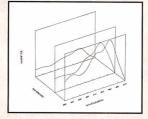












Statistics Basic statistics, frequencies, t-tests, post-hoc tests Multiway crosstabs with log-linear modeling, association coefficients, PRE statistics, Mantel-Haenszel, asymptotic standard errors Nonparametric statistics (sign, Runs, Wilcoxon, Kruskal-Wallis, Friedman two-way ANOVA, Mann-Whitney U, Kolmogorov-Smirnov, Lilliefors, Kendall coefficient of concordance) Pairwise/ listwise missing value correlation, SSCP, covariance, Spearman, Gamma, Kendall Tau, Euclidean distances, binary similarities Linear, polynomial, multiple, stepwise, weighted regression with extended diagnostics Multivariate general linear model includes multi-way ANOVA, ANOCOVA, MANOVA, repeated measures, canonical correlation Principal components, factor analysis, rotations, components scores Multidimensional scaling Multiple and canonical discriminant analysis, Bayesian classification Cluster analysis (hierarchical, single, average, complete, median, centroid linkage, k-means, cases, variables Time series (smoothers, exponential smoothing, seasonal and nonseasonal ARIMA, ACF, PACF, CCF, transformations, Fourier analysis Nonlinear estimation (nonlinear regression, maximum likelihood estimation, and more).

**Graphics** Overlay plots Drivers for most graphics devices Two dimensional: Error Bars Scatterplots Line and Vector Graphs Vector, Dot, Bubble and Quantile Plots Bar Graphs (single, multiple, stacked, range) Box plots (single and grouped) Stem-and-leaf diagrams Linear, quadratic, step, spline, polynomial, LOWESS, exponential smoothing Confidence Intervals and ellipsoids (any alpha value) Smooth mathematical functions Rectangular or polar coordinates Log and power scales ANOVA interaction plots Histograms (regular, cumulative, fuzzy) Stripe and jitter plots Gaussian histogram smoothing Scatterplot matrices Voronoi Tesselations Minimum spanning tree Maps with geographic projections (U.S. state boundary file included) Chernoff faces Star plots Fourier plots Pie charts Contour plots on regularly and irregularly spaced points Control charts and limits Three dimensional: Data plots Smooth function plots Vector plots Linear, quadratic, spline, least squares surface smoothing Threedimensional type fonts.

Data Management Import/export Lotus, dBase, and DIF files Full screen data editor Full screen text editor Unlimited cases Missing data, arrays, character variables Process hierarchical, rectangular or triangular files, irregular length records Character, numeric, and nested sorts Merge and append large files Unlimited numeric and character variable transformations Subgroup processing with SELECT and BY Value labels and RECODE Statements Macro processor with programming language, screen control, file manipulation, applications generation, and report writing.



Systat operates on IBM PCs and compatibles, MS-DOS and CP/M machines, several UNIX minicomputers, and the VAX/Microvax. Menu/windowed Macintosh version also available. Single copy price \$795 USA and Canada, \$895 Foreign. Site licenses, quantity prices and training seminars available. No fees for technical support. Statistics and graphics available separately.

For more information, call 312 864.5670 or write Systat Inc., 1800 Sherman Avenue, Evanston, IL 60201.

The following are registered trademarks: CP/M of Digital Research, Inc., IBM PC of IBM, Inc., MS-DOS of Microsoft, Inc., Macintosh of Apple Computer Inc., UNIX of AT&T and VAX of Digital Equipment Corporation.

#### Systat. Intelligent software.



# Turbo Prolog Revisited



Version 2.0 offers enhanced database and graphics features

Alex Lane

rogramming languages and their implementations fuel endless debates within the microcomputing community. Should an implementation provide precisely those features set forth in the language's definition, or should it alter that definition for the convenience of the implementer and the user? Borland International's language products—mentioned often in such debates—fall into the latter camp, and its Prologs are no exception to

the rule. Turbo Prolog 2.0 stretches the language even more than did the original Turbo Prolog 1.0 (September 1986 BYTE).

Borland's Prologs enforce strong typing of objects and relations (Edinburgh Prolog, the de facto standard, doesn't) and limit the assert and retract mechanism to facts alone (Edinburgh supports dynamic modification of facts, predicates that define relations, and rules involving those predicates).

Despite these impurities, Turbo Prolog has found a following. Users appreciate features like fast compilation, linkage to stand-alone .EXE, foreign-language compatibility, integrated edit and debug facilities, and the rich assortment of built-in predicates that work with numbers, strings, files, windows, the Prolog database, and the DOS environment. Turbo Prolog 2.0 upgrades these capabilities and breaks significant new ground in two areas—graphics and the database system.

Though straightforward, the installation process isn't completely intuitive. For example, to install it on a hard disk you must make the hard disk drive, not the floppy disk drive, your default drive; in my opinion, that detail should be transparent to the installation routine. Once begun, installation of Turbo Prolog is a mindless, disk-swapping affair. Many of the files are bundled into archives; the installation program spends most of its time unarchiving them. At the end, it reminds you to insert the commands FILES=20 and BUFFERS=40 into the CONFIG.SYS file.

You'll need just under 1.5 megabytes of free space on your hard disk to install all the files that come with Turbo Prolog 2.0. A root directory contains the compiler, the core library PROLOG.LIB, the librarian, and the linker. Five subdirectories contain Borland Graphics Interface (BGI) drivers and font files; all the sample code shown in the documentation; answers to tutorial problems; model Prolog applications like Geobase (a geographical database that supports natural-language queries) and the Prolog Inference Engine (PIE), an Edinburghstyle Prolog interpreter written in Turbo Prolog; and reference examples comparing the use of the old and new standard predicates.

To use Turbo Prolog 2.0, you'll need an IBM PC, XT, AT, PS/2, or true compatible, PC-DOS or MS-DOS 2.0 or higher, and a minimum of two floppy disk drives and 384K bytes of memory. Such a system would be barely usable (the installed Turbo Prolog would be spread out over five disks), so I wholeheartedly agree with Borland's minimum recommended system—a hard disk drive and 640K bytes of RAM. I evaluated the package on a 16-MHz ARC 386i equipped with a multiscan monitor, a hard disk drive, and 512K bytes of RAM, and also on a 4.77-MHz IBM XT equipped with a CGA, a hard disk drive,

continued

#### **Turbo Prolog 2.0**

#### Type

Prolog programming language

#### Company

Borland International 1800 Green Hills Rd. P.O. Box 660001 Scotts Valley, CA 95066 (800) 543-7543 (408) 438-8400

#### **Format**

Four 51/4-inch floppy disks

#### Language

C

#### **Hardware Needed**

IBM PC, XT, AT, PS/2, or true compatible; 384K bytes of RAM (640K bytes of RAM recommended); dual floppy disk drives (hard disk drive recommended)

#### **Documentation**

480-page user's guide 462-page reference guide

#### Price

\$149.95

Inquiry 888.

an 8087 math coprocessor, and 640K bytes of RAM.

#### **General Improvements**

Most Turbo Prolog 1.x programs will compile unchanged. Those that won't are ones that refer across module boundaries to domains, databases, or predicates; you must now explicitly declare these elements to be global. Also, version 2.0 assumes that global predicates are deterministic (i.e., not expected to generate multiple solutions). That assumption enables the compiler to emit more efficient nonbacktracking code in situations that don't require backtracking. You must qualify a global predicate with the keyword nondeterm to make it nondeterministic.

The files domain now supports stdin, stdout, and stderr. These names, familiar to C programmers, enable Turbo Prolog programs to communicate with other programs by means of DOS pipes. C programmers will also appreciate new directives for conditional compilation (ifdef, ifndef) and the capability to define constant expressions.

You can log the debugger's output directly to a file or printer; this feature

really helps when you're trying to track down strange program behavior in the middle of a trace. You can enable or disable run-time checks for integer and stack overflow, and you can control the size of the heap available to a compiled Prolog program.

TLIB, the librarian, stores predicate object modules in library files. I use it to reduce disk clutter; by archiving source code on floppy disks and storing the corresponding object code in a library, I minimize the number of .PRO files in my Prolog environment.

Several command-line parameters are now available with Turbo Prolog. The -e flag loads a specified file into the editor; by default, it loads WORK.PRO. The -s flag loads a setup (.SYS) file. You can enable or disable snow-checking with -c. And the -x flag enables Turbo Prolog's high-resolution text modes (43 or 50 rows by 90, 120, or 132 columns).

The syntax of the language has been changed in ways that move it closer to traditional Prologs. Comments, which in version 1.x programs required the C idiom /\* . . . \*/, can appear as the remainder of any line that begins with a percent sign. Predicates can now have multiple arities. For example, a predicate called sales\_contact might have two forms, one describing a name and address relation and another describing a name, address, and phone-number relation. In documentation, you'd write sales\_contact/2 and sales\_contact/3; in code, you'd write sales\_contact and let the compiler choose, based on the number of arguments supplied.

Many of the standard predicates now have multiple arities. The makewindow predicate, for example, has two forms; makewindow/8 does the basic job, and makewindow/11 adds control over the style of the frame and position of the title. Some new standard predicates are bios/4, which returns the status of flags; edit/13, an upgraded version of the original edit/2 facility that gives Prolog programs access to the Turbo Prolog editor for complex I/O; and exit/1, which sets the DOS errorlevel.

**Database Support** 

The database portion of Turbo Prolog has been almost completely redesigned. In the old scheme, a single internal database served as the repository for facts. You filled it from three sources: database predicates in source code; database predicates stored in a separate file and accessed by means of consult; or assert predicates contained in clauses or a goal. The retract predicate deleted a fact,

and save wrote the contents of the database to an external file. Available RAM limited the size of the run-time database. Although the 1.x documentation hinted at a way to virtualize the database, it was disk-intensive and involved a laborious indexing scheme.

Version 2.0 preserves and extends the internal database facility. Now you can name multiple internal databases, and you can consult or save each separately. New versions of consult, save, assert, and retract work with these named internal databases. To use a database across module boundaries, you must declare it in the global database section and declare its predicates in the global predicates section. As before, the amount of RAM limits the size of internal databases.

The new external database implements a virtual store of facts. You can put an external database in RAM or expanded memory, if there's room, or you can put it on a disk file. An external database is made up of one or more chains (linked lists) of terms and, for each chain, an associated B+ tree is used to index it. New predicates analogous to save, consult, assert, and retract work with external databases. The specialized accessors db\_chains and chain\_terms bind entire chains or individual terms to Prolog variables during backtracking. You can use the bt\_ (B+ tree) predicates to sort chains and gain fast keyed access to terms.

The internal and external databases aren't compatible with one another. You can't use assert or retract with an external database, nor can you chain internal predicates. But that's logical, since terms belonging to an internal database are actually part of a Prolog program, while terms belonging to an external database are data manipulated by that program. This arrangement isn't unique to Turbo Prolog 2.0. Arity/Prolog 4.0 implements something quite similar. The Turbo Prolog 2.0 documentation devotes a full chapter to external databases. Sample programs clearly illustrate how to scan, update, restructure, protect, and display them.

**Borland Graphics Interface** 

If you've had a chance to play with Turbo Pascal 4.0, you're probably familiar with the BGI. The BGI comes with Turbo Prolog 2.0 as well. It supports CGA, MCGA, EGA, VGA, Hercules, AT&T 400-line, 3270 PC, and IBM 8514 graphics adapters. Turbo Prolog 2.0 offers more than 70 new standard predicates; they create and manage viewports

(graphics windows), draw shapes such as circles and rectangles, and define patterns used to fill shapes. All these new features get a workout in the sample program GRDEMO.PRO. Though at first graphics and Prolog might seem an odd mixture, I can think of some interesting applications combining the two. A system of artificial intelligence-based controls for a water treatment plant could graphically represent water levels and flow patterns. A circuit-board troubleshooter could illustrate where to put logic probes, or could display waveforms.

There are two ways to package code that uses the BGI. The easiest way is to compile and link the Prolog program, then run the resulting .EXE file in the presence of the drivers (.BGI files) and fonts (.CHR files). The disadvantage here is that the program has to be able to locate these files. Alternatively, you can use the new bgidriver and bgifont compiler directives, which specify the drivers and fonts you want to attach to your program. This approach consolidates your application into a single file. But that file is substantially bigger—a program that incorporates all the drivers supplied with the package grows by almost 30K bytes.

#### **Foreign Languages**

Though version 1.x could link Prolog programs with external routines written in foreign languages, the feature never worked to my satisfaction. Happily, version 2.0 is fully compatible with Borland's Turbo C. You can write C routines that support Prolog predicates, as before. You can even call Prolog predicates from C; the catch here is that the main program must be implemented in Prolog, so Prolog can control the stack and heap.

Not having a current version of Turbo C close at hand, I linked a simple C routine compiled under Microsoft C (version 5.0) with a program written in Turbo Prolog 2.0. Despite a few complaints from the linker about undefined symbols, I could call the routine successfully from Prolog. Despite all this, I remain skeptical about the usefulness of the language interface. In theory, it's a great way to subcontract computing tasks that Prolog doesn't handle well, like numerical analysis and sophisticated string handling. In practice, you have to own another Borland language product, and you need more than a passing acquaintance with concepts like memory models.

#### Sample Programs

Turbo Prolog 2.0 comes with a wealth of sample programs. These serve two pur-

**Table 1:** Turbo Prolog 2.0 lags behind version 1.1 on number-crunching tasks but betters its predecessor in symbolic computation.

* 3	Source file		.EXE file		nory ipile		npile/ nk	Run time tes:seconds)		
	(bytes)	(bytes)		(seconds)		-	(minu			
Test		1.1	2.0	1.1	2.0	1.1	2.0	1.1	2.0	
Floating point	635	35,503	32,436	2	2	0:15	0:18	0:30	0:36	
List reversal	908	35,854	29,923	2	2	0:15	0:18	0:23	0:11	
Sieve	973	35,790	26,323	2	2	0:15	0:18	0:03	0:03	
Math sqrt In exp atan sine	1456	38,526	33,251	5	4	0:17	0:21	0:05 0:14 0:24 0:15 0:16	0:06 0:14 0:24 0:16 0:16	
Factorial	656	35,546	37,055	2	2	0:14	0:17	0:21	0:31	
Towers of Hand 10 rings 7 rings 5 rings	oi 677	35,478	29,067	2	2	0:14	0:17	0:11	0:16*/0:34* 0:02*/0:04* 0:01*/0:01	
Disk write	605	36,425	27,854	2	2	0:14	0:17	0:29	0:29	
Disk read	470	36,444	30,625	2	2	0:14	0:17	0:16	0:16	

Snow-checking off.

poses: They teach Turbo Prolog by example, and more generally, they motivate the study of some classic problems that Prolog helps to solve. Borland, as always, provides source code for these applications so you can study and try to modify them. In a welcome change from version 1.x, the documentation describes these applications.

Geobase is a database that contains information about the geography of the United States and a natural-language query facility that lets you ask questions like "What is the largest city in Mississippi?" The documentation tells how to compile and link the program, outlines its architecture, and suggests how to extend it to other domains. SEN\_AN, a sentence analyzer, uses a context-free grammar to parse simple English sentences. GENI, an expert-system shell, comes with a small knowledge base containing definitions of various kinds of animals. In consultation with GENI, you specify an animal's attributes (e.g., "has feathers," "doesn't have long legs"), and the program seeks to identify the animal in question. GENI has an update mode, too. When it can't identify the animal you have in mind, the program can help you add it to the knowledge base. The documentation, again, suggests ways for you to extend the application into other

The PIE impressed me most of all. PIE is a small but powerful Prolog interpreter that, unlike Turbo Prolog itself, permits the user to assert and retract both facts and rules. The appendix that describes PIE is dense and, at times, patronizing of traditional Prolog implementations, but nonetheless it's an education in the esoteric art of Prolog interpretation. The program does have its bugs. I noticed that when goals are resatisfied during backtracking, the trace window displays the old instantiated variables rather than anonymous variables. In addition, I had to reboot my XT with a DOS-only disk in order to compile PIE with the trace mode enabled. Nevertheless, I was able to load and run an unmodified copy of the Prolog chestnut QUEENS4.PRO.

Nearly 1000 pages of high-quality documentation accompany the software. That's a great improvement over the version 1.x manual in terms of both quantity and quality. The new documentation set divides into two hefty tomes: a 480-page user's guide and a 462-page reference guide. The user's guide explains how to install the package on your computer, how to set up the environment, and how to get started with the editor. Then it dives into Prolog. Topics include backtracking, unification, lists, recursion, strings, windows, files, graphics, databases, and debugging.

Most of the reference guide is devoted to the description of version 2.0's stan-

continued

Snow-checking on.

dard predicates. The rest of the book features a programmer's guide, a list of error messages, and a series of appendixes describing the applications that come with Turbo Prolog 2.0.

#### **Better Performance?**

For testing purposes, I used a 4.77-MHz IBM PC XT with a hard disk drive, an 8087 coprocessor, and 640K bytes of memory. I tested versions 1.1 and 2.0 using the same benchmarks that were used for the BYTE review of version 1.0. There's one minor change—I modified the floating-point test so that it passes intermediate results on recursive calls.

The floating-point tests measure the time required for 5000 iterations of a set of floating-point multiply and divide operations. The list-reversal test, adapted from a Lisp benchmark, clocks 30 reversals of a list of 50 integers. The Sieve of Eratosthenes finds all the prime numbers between 1 and 100, 10 times. The math benchmark performs 1000 calculations each of square root, natural logarithm, exponential, arctangent, and sine functions. The factorial test computes 10! 1000 times. The Towers of Hanoi benchmark writes a narrative description of the solution to that puzzle for 5, 7, and 10 rings. Finally, the disk read and write benchmarks write a 64K-byte file to a floppy disk drive and read it back.

Version 2.0 produced code that was 20 percent to 30 percent smaller than that produced by version 1.1 (see table 1). Somewhat surprisingly, 1.1 outperformed 2.0 on the math-intensive benchmarks. That result doesn't particularly concern me, however; Prolog isn't a number-crunching language. If you need those capabilities in a Prolog context, consider linking appropriate routines written in assembly language or C. Prolog's strength is symbolic computation, and on those benchmarks-the list-reversal test and the Towers of Hanoi-2.0 significantly outperformed 1.1. The results for the Towers of Hanoi with and without snow-checking, by the way, show the rate of text output to the screen to be an important limiting factor.

#### A Mature Environment

Like its predecessor, Turbo Prolog 2.0 isn't a traditional Prolog; the language is strongly typed and doesn't let you dynamically assert and retract rules. But logic programmers aren't necessarily complaining. Many, for example, support Turbo Prolog's strong typing. In any case, as Prolog implementations proliferate, it's getting harder to point to a definitive standard.

Turbo Prolog 1.0 was a useful and popular implementation of Prolog. Borland International has raised Turbo Prolog 2.0 a cut above that. The external database puts serious knowledge-crunching capability into the hands of Turbo Prolog programmers, and the BGI features should yield some interesting graphical applications. Traditional it may not be, but Turbo Prolog has certainly become a mature environment for logic programming.

Editor's note: The Prolog source code for the benchmarks is available in a variety of formats. See page 3 for details. ■

Alex Lane is a knowledge engineer for Technology Applications, Inc., and lives in Jacksonville, Florida. He can be reached on BIX as "a.lane," where he is the moderator of the prolog conference.

#### All the Power of A 25 MHz 386 At Half the Price of Compaq or IBM Omega 386/25 <u>\$329</u> 386/16

Complete High Quality 386/25/20/16 Systems

Omega 386/25/20/16 Motherboard Hard/Floppy Controller 1:1 Interleave I/O Card (Parallel, Serial, Game Ports) Two 32 Bit, Four 16 Bit, & Two 8 Bit slots Monochrome Graphics/Printer Adapter 1 Mb 80ns Memory (expandible up to 16 Mb)

\* Ram Cache 386 soon available

Toshiba 40Mb 25ms Hard Drive Teac 1.2Mb Floppy drive 101 Key Enhanced Keyboard 230 Watt Power Supply AT Case Turbo/Leds, 5 Drive Slots Packard Bell TTL Amber Monitor

\* Tower Case available

All systems are custom assembled and burned in by OMI technical personnel and come with a 1 year warranty on parts & labor. All Prices Subject to Change without notice. IBM & Compaq are Trademarks of their respective Corporations.

286/20 \$1895 286/16 \$1795 286/12 \$1495

**Test Results** 386/25 286/20 Norton SI Ver 4.0 28.2 27.3 Landmark Ver .99 33.6 26.7 Power Meter Ver 1.20

The Fastest 286 Available 286/20/16/12 System Specs 286/20/16/12 Mother Board

\$795.00

Omega 286 Award BIOS Hard/Floppy Controller 1:1 Interleave
I/O Card (Parallel, Serial, Game Ports)
Six 16 Bit Slots & Two 8 Bit Slots
1 Mb Memory Installed

10MHz XT Motherboard (Phoenix BIOS)

Floppy VO Controller (2F,CLK,PP, SP, GP)

Monochrome Graphics/Printer Adapter

Teac 360K Floppy Drive Packard Bell TTL Amber Monitor

AT Jr Case Turbo/Leds Keytronics 101 Key Keyboard

150 Watt Power Supply

640K Memory Installed

8 Expansion Slots

Teac 1.2Mb Floppy Drive
101 Key Enhanced Keyboard
230 Watt Power Supply
AT Case Turbo/Leds, 5 Drive Slots
Monochrome Graphics/Printer Adapter
Packard Bell TTL Amber Monitor

**Printers** Omega 88/10 XT Compatible Panasonic 1080i

1091

1092 1592 1595

**Hard Drives** Toshiba 40Mb 25ms 70Mb 25ms \$181 \$543 \$895 \$222 \$361 Micropolis 72Mb 28ms Miniscribe \$610 8425 20Mb 65ms \$281 <u>Modems</u> 8438 20Mb 65ms 3053 40Mb 25ms 3085 72Mb 28ms 6085 72Mb 28ms \$287 \$618 \$720 \$966 \$57 \$95 \$103

Floppy Drives Teac 720k 3.5" 1.44M 3.5" \$115 \$125 1.2M 5.25"

SMS Omti \$83 \$144 5527 XT RLL 8240 AT MFM 510 SCSI 512 SCSI \$80

**Monitors** Samsung White Mo Packard Bell Mono \$80 \$110 Thomson Mono Princeton MAX12 Thomson CGA Mitsubishi CGA \$269 \$375 Packard Bell EGA \$386 \$408 \$528 Samsung EGA Mitsubishi EGA

4.25 Mips

lines offered: Video Seven Keytronics Northgate Archive Novell **AutoDesk** Epson Western Digital DTC

3.64 Mips

Other product

Call For More Information Including Complete Product Catalogue OMEGA MICAOSYSTEMS

2400I 2400E

1029 Franklin Road Suite 4-C Marietta, Georgia 30067

Toll Free (800) 346-6527 In Georgia (404) 429-8862 (404) 953-6286

Hours: 9am-8pm EST Monday thru Friday

\$443

\$582

We Will Gladly Answer Any Customer's Technical Questions!

Mitsubishi Multi

Technica Multi

Tatung VGA

## YOU CAN'T BEAT THE BOSS

#### DATABOSS APPLICATION GENERATOR for Turbo Pascal V4.0 and Turbo C

- The simple and revolutionary new 4GL used to develop sophisticated relational database applications.
- Lets you design and paint data entry screens and datafile layouts, as well as menus and reports.
- Automatically generates the solid. structured Pascal or C source code that makes up your finished system.
- DATABOSS is only \$399 and it's complete. You need only Turbo C or Turbo Pascal V4.0.



#### DATABOSS TOOLS

An integrated, intelligent, high level interface to DOS for managing Files and Console input and output. Available as an independent package for \$99. An invaluable adjunct to DATABOSS Application Generator.



#### DATABOSS

#### COMPONENTS

#### INCLUDE

#### THE FOLLOWING:

#### **MENU GENERATOR:**

- Unlimited menu nesting
- Call internal DOS commands and external .EXE .COM and .BAT files with parameters
- Include your own initialization and exit routines
- Nine security levels and modifiable password file

#### SCREEN PAINTER:

- Free form full screen editor
- Draw lines and boxes full IBM extended character set
- Copy, move, insert, center text
- Color painting, foreground, intensity and background

#### DATAFILE AND

#### **FIELD DEFINITION:**

- Each field defined via a 4GL
- Up to 16 related datafiles per application module
- 16 index keys per datafile unique or duplicate
- Up to 9 segments per index
- Allows multiple use of fields in key segments
- Automatic datafile linking
- Dynamic traceback of linkages
- Unlimited number of open files
- Character input control via
- Any field default value allowed
- Full field validation via **BOOLEAN** check
- User defined error messages
- Compute and key expressions
- Automatically generated re-indexing module
- Automatically generated datafile reconfiguration module

#### THE MOST POWERFUL **RELATIONAL REPORT**

#### **GENERATOR EVER**

#### DEVISED

- Design any type of report
- Automatic structure definition for relational reports
- A report element can be a field, text, function

- Unlimited number of totals and subtotals
- Send report elements to CON. LST, RS232, DSK individually or simultaneously
- Paint and build report range selection screens
- Print multiple records across

#### **IMPEX QUERY BY**

#### **EXAMPLE MODULE**

- Import external ASCII files into your DATABOSS database.
- Query datafiles using point and select cursor movements
- Select fields to be output and specify order
- Impose conditions for data selection
- Select index or create ad hoc
- Output to screen, disk or printer

#### **PROGRAMMERS CAN**

#### **CUSTOMIZE AND**

#### **MAKE APPLICATIONS**

#### MORE POWERFUL

- Write your own functions, initialization and exit routines and include them in the function table
- Customize a skeleton file and use this file at generation time

#### **GENERATE AND**

#### **COMPILE USING**

#### **TURBO PASCAL**

#### V4.0 OR TURBO C

- Generate 1000 lines of code in 10 seconds
- Compile to produce fast executable object code
- No runtime licence fees
- We provide you with end user screen and printer installation modules to include in your menus



On receipt of your returned of the receipt of your return configuration of the return configuration returns to the return of the Generator Hegistration Conference of Systems Will Top Gun Systems Will Send you are introductory CASH BACK of \$25.

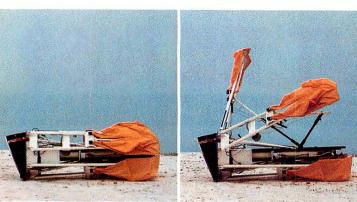


Rush coupon below to: TOP GUN SYSTEMS. 4 COTTAGE AVE., MILL VALLEY, CALIFORNIA. 94941. PHONE: (415) 461 4040. FAX: (415) 388 9226.

OR FOR ORDERS PHONE:

(800) 323 7767.

Trademarks: DATABOSS by Top Gun Systems. Turbo Pascal and Turbo C by Borland International

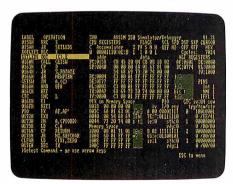


# OUR µP DEVELOPMENT TOOLS

## HELP PROJECTS GET ON THEIR FEET. The "creature" shown above doesn't

depict a futuristic lunar landing. Rather, it represents a polar landing of a sophisticated weather monitoring device. A new parachute-deployed device that instantly transmits vital environmental data to waiting scientists. And whose Antarctic installation and erection now happen automatically, in a matter of minutes, allowing critical data collection in remote areas that were impossible to reach before.

This "Self-Erecting Weather Station," sponsored by the National Science Foundation and designed and developed by Polar Research Lab, was made possible by Avocet and AVSIM™, Avocet's unparalleled simulator/debugger.



The AVSIM Full-Screen Display

#### Unequaled capability

Polar Research needed AVSIM's sophistication to control the sensors in the weather station's "legs" and to create its transmitter. AVSIM's detailed on-screen CPU simulation, unlimited breakpoint facility, and unique "undo" capability gave their engineers the ease of use and flexibility that allowed them to execute and test the software even before the hardware was ready. Saving crucial time and frustration in both the programming and testing phases of development. And money, too: at only \$379, AVSIM is a fraction of the cost of additional hardware

#### Complete compatibility: from the ground up

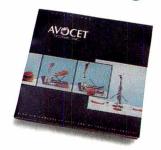
Best of all, AVSIM is completely compatible with our AVMAC™ macro assemblers and our AVOCET C™ cross compilers - the ideal combination of tools which gives you a comprehensive development solution.



#### Get your own project off the ground: try before you buy

Try the AVSIM demo yourself for 30 days. If you're not satisfied for any reason, return the unopened program disk for a full refund - less \$35 for the demo disk and manual, which are yours to keep.

#### Free Catalog



#### Call Toll-Free 1-800-448-8500\*

For your free catalog, to order, or for more information about AVSIM and other Avocet products.

Call Avocet today and ask about our complete line of affordably priced software and hardware  $\mu P$  development tools. Discover how we can help you get your next project on its feet, too.

©1988 Avocet Systems, Inc. All rights reserved

THE SOURCE FOR QUALITY UP DEVELOPMENT TOOLS

Avocet Systems, Inc., 120 Union St., P.O. Box 490AV, Rockport, ME 04856 /\*In Maine, or outside U.S., call (207) 236-9055 / TLX: 467210 Avocet CI / FAX: (207) 236-6713



# D the Data Language

```
Personal interface definition STORE has compiled successfully.

Personal interface STORE has 10 record descriptions.

rd CUS_REC rec has 15 fields; 104 chars.

rd INU_REC rec has 8 fields; 45 chars.

rd SAL_REC rec has 9 fields; 50 chars.

rd URL_REC rec has 11 fields; 89 chars.

rd ORD_REC rec has 14 fields; 96 chars.

rd PAR_REC rec has 7 fields; 58 chars.

rd ASS_REC rec has 2 fields; 27 chars.

rd STA_REC rec has 2 fields; 14 chars.

rd CAT_REC rec has 2 fields; 14 chars.

rd HIS_REC rec has 9 fields; 64 chars.

C:\DDD\STORE.PI has been updated.
```

A powerful tool for storing and manipulating data

Pam Oppenheim

he manual to D the Data Language advises that "D is a very different animal in many respects. Not difficult, just different." And it's right—D is very different from the majority of PC database packages. It is a DBMS that, for example, lets you create custom applications for every user who accesses the database. A number of people can, therefore, get only the information they need without seeing confidential or extraneous data.

Indeed, D is a powerful, flexible tool for manipulating data. First, it provides a mechanism for getting information into a database, and then it supports development of integrated menus, procedures, reports, and screens. But this flexibility is not always immediately apparent.

D (\$395) comes with two spiral-bound manuals, a small addendum for the latest version, and four 360K-byte 5¼-inch floppy disks. The addendum, included with version 2.7, which I reviewed, covers new features, such as pop-up

menus, color monitor support, the ability to recover deleted records, new options for many commands, pie charts, bar graphs, histograms, and a facility for building context-sensitive help for your applications.

A batch file handles the installation and lets you put D in the subdirectory of your choice. The batch file prompts you for the three program disks and checks that you've inserted the correct one. The program is not copy-protected. The fourth disk contains an example database, which you copy into the subdirectory with D. The program requires 512K bytes of RAM and a hard disk drive (it uses about 1 megabyte). I ran D on a Compaq Deskpro that uses an 8086 processor at 7.14 MHz with a 20-megabyte hard disk drive.

#### D in Action

Within D, information is organized as database definitions (DBDs) that contain data groups, which are analogous to files, procedures for menus, automated processing, and reports. Data groups are defined as fields, supporting alphanumeric or numeric character and binary field types. Subfields are supported and add to your ability to control and access information. For example, a master field-name job number can consist of a customer number, a sequence number, and the year. You can reference the single entity or any of the components.

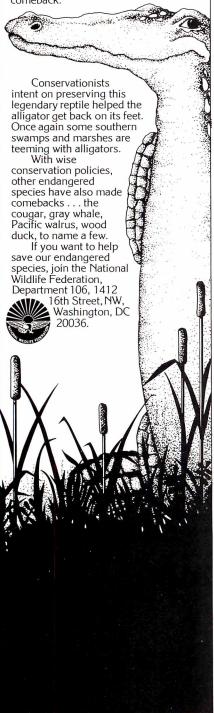
The lack of a date type is inconvenient. However, using the JDATE and EDATE functions, which convert character data from a specified format to the equivalent Julian date or calendar date, procedures can be developed to process dates as needed. The starting date for Julian calculations is user-definable as part of the database definition. If you set up a dates field with subfields, it's easy to pull reports for specific periods without any date conversion required at all.

You must compile the DBDs and pro-

# Back, by popular demand.

Just a few years ago, illegal hunting and encroaching civilization had all but destroyed the alligator population in the south. They were added to the official list of endangered species in the United States

Now alligators have made a comeback.



#### D the Data Language 2.7

#### Type **DBMS**

#### Company

Caltex Software, Inc. 3131 Turtle Creek Blvd., Suite 1101 Dallas, TX 75219 (214) 522-9840

#### **Format**

Four 360K-byte 51/4-inch floppy disks

#### Language

#### **Hardware Needed**

IBM PC, XT, AT, or compatible with 512K bytes of memory, one floppy disk drive, and one hard disk drive

#### Software Needed

DOS 2.0 or higher

#### **Documentation**

136-page Introduction Manual 367-page User's Guide

#### Price

\$75 for the run-time module

Inquiry 889.

cedures before you use them. Part of the data group definition is the number of records it contains. When the file is full, you can't add more information without updating the DBD. Changing a database is a multistep process that, at the very least, requires you to unload data from the DBD into a temporary file, make the modification, recompile the DBD, modify and recompile procedures if you've changed any DBD names, open the DBD, and reload it. After verifying the data, you must edit procedures to reflect the new field types and sizes and recompile them again. Finally, you must rebuild the keyed field references. Sometimes, flexibility has a high price.

An INFO command lets you know all about your database, from the basic structure to the number of loaded and active records. A uniqueness column shows you the number of unique values that exist for a particular field. An associated command, REDUCE, lets you compress a set of isolated records to reflect only the unique values. This is similar to dBASE's UNIQUE qualifier on indexes, but it's more flexible since it does not limit access.

To Caltex's credit, it advises users of the importance of establishing backup

and reload procedures for all DBDs. In fact, the company goes so far as to include a chapter in the documentation on database maintenance and recovery. STRUCTURE, CONSTRUCT, DESTRUCT, and KEY help you rebuild keyed fields should they become damaged. Yet, in working with D, I experienced no data losses, even when I purposely turned off the power while updating a file.

To DOS, a database definition represents only four open files, regardless of how many data groups and procedures exist. D supports an unlimited number of data groups, keyed fields, and related files within a DBD.

Confusion arises when you first try to use these keyed fields, because the data is displayed in the order in which it was entered. The terms key and keyed index files imply that the data is ordered on the value. I determined that, unlike dBASE's index files or indexed sequential-access method file structures, keyed fields do not generate index files or, in any other way, impose a visible structure on the data. The keyed field provides an internal structure used by the FIND command to isolate records within the data

There are trade-offs to either approach. Imposing the structure takes time during all data-entry and update activity and makes the system more vulnerable to corruption during power failures. Without that structure, you must organize your data via sorts every time the order is important.

#### **Sorting It Out**

Fortunately, D's sorts are fast and powerful. A sort lets you specify multiple fields, ascending and descending orders, and case insensitivity. An option enables you to specify the use of high instead of low values for missing data. You can apply sorts to a collection (isolated portions of files) or to an entire data group. The sorted order remains in effect until you sort on another field, add records to the working set, clear the collection, or close the database. A singlefield sort of 1586 records took less than 2 seconds, while the comparable dBASE sort (I used dBASE III Plus 1.1) took 4 minutes and 27 seconds and also took up valuable disk space.

D's PICK, FILL, and FIND commands are the mechanisms for isolating data. They more closely resemble dBASE's FOR and WHERE clauses than its SEEK command. dBASE's SEEK command located a record and advised me that a record did not exist in less than 1 second using my

continued



# Which would you like to see first? The world's fastest dBASE compiler or the most powerful database development language?

Surprise. Now you get both in the same package. New Clipper™ from Nantucket."
Our latest version—Summer '87—is still the best-

performing compiler ever. It lets users run dBASE\* applications up to 20 times faster. But there's a lot more to it than raw speed.

Because new Clipper is one of the most powerful, full-featured development languages ever. And gives you more control over your applications than any release of dBASE ever will. Now or in the future.

Instead of designing Clipper as an add-on, we've structured it as an extended database language that uses dBASE as a subset. In addition to emulating the dBASE language, we've added commands for menus, screens, windows and extended functions. As a result, you get dBASE compatibility and an entirely new level of power and versatility.

And with Clipper's open architecture, you can write functions in Clipper, C, Assembler or other languages, and integrate them into one seamless application. Which helps you create more sophisti-

© Nantucket Corporation, 1988. Nantucket is a registered trademark and Clipper is a trademark of Nantucket Corporation. dBASE is a registered trademark of Ashton-Tate

cated applications in less time. And by using our full-featured debugger, you'll be done even faster.

We also give you source code security that keeps users from damaging your application. And sophisticated record and file locking capabilities that make networking applications easier to create. But no matter what you create, you don't have to buy runtime modules or additional software. You don't even have to pay licensing fees.

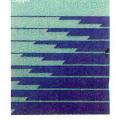
If you haven't tried Clipper yet, just call (213) 390-7923 today. We'll send you full information and a free demo diskette. Or the complete program, if you'd rather.

But call today. And see how easy it is to find the best dBASE development

language. Just get the fastest compiler. And open the box.



Nantucket, 12555 W. Jefferson Boulevard Los Angeles, CA 90066 Telex: 650-2574125





## A Clear View To Monitor Quality

REVIEW

D THE DATA LANGUAGE

1586-record file. The FIND command isolated matching records in just over 2 seconds. But FIND allowed me to look at these matching records nearly instantaneously, while dBASE's BROWSE FOR and DISPLAY FOR were slow in writing just the first 16 entries to the screen. FIND is the means for loading data records into memory from a data group. A WHERE clause that supports greater than, equal to, less than, starting value, and an "any value" expression provides control over which records are retrieved. The any value operator is extremely powerful, locating records if the contents of the field contain the value. This capability does not exist in dBASE. PICK supports locating information by record numbers rather than by values. You can specify single records or ranges of records to be retrieved.

#### **Command and Control**

You can edit any command that is still on the screen; simply move the cursor to the command and press Enter. The line is now redisplayed as the next line to execute, and you can edit the line before execution. Context-sensitive help is always available by pressing F1. The use of a split screen when displaying help lets you complete a command easily by following the displayed syntax. You can look up field names in the same fashion. I found this process far superior to that of manually writing down the syntax while in help so that I could enter the command correctly when I exited help.

Creating moving light-bar menus was a delight. From the procedure menu, I selected MENU, and, using the text editor, I listed the procedure names and descriptions. To mark the options for the menu, I placed the cursor to the left of the procedure name and pressed F5, for each allowable menu selection. D automatically handles all the cursor control and highlighting, then invokes the selected procedure.

On the down side, there is no typeahead buffer and no indication that what you've typed has gone to never-never land. Most commands, except for compiles, execute fast enough so that this is not a major problem. Still, I would have preferred to receive a warning from the program, rather than having to type the commands all over again.

A text editor lets you create reports, procedures, screens, and even the database definition. The editor supplied with D is adequate, providing insert and overstrike modes, full-screen and line-edit modes, and block moves and copies. You can use any text editor that creates pure ASCII files; however, you can't invoke the editor from D, resulting in a loss of productivity.

Within the screen definitions, you have access to a wide range of field edits, including required, unique, fill, uppercase conversion, and auto-increment. Templates, ranges, and lists are fully supported. As it does with moving light bars, D handles all the specified edits from the menu to enter or edit data without any user-generated code. When specified conditions have not been met, a terse prompt like ALPHA or REQUIRED appears on the screen and a beep sounds. Unless the override option is invoked, you must correct the response before D proceeds to the next prompt.

UPDATE and APPEND commands let you enter and edit information in the data file. When using screens, you must be on

Only one supplier of color monitors offers the widest selection of features and operating flexibilities in the market today.

That company is Mitsubishi Electronics.

Mitsubishi® delivers the reliability and performance that can meet your color information display requirements today as well as tomorrow. Larger screen sizes, truer colors, and optimum resolutions make your work easier—and far more productive.

Whether your requirements call for fixed-frequency graphics standards, like EGA and VGA, or multiplefrequency performance, Mitsubishi has the color monitor with the resolution and size to fit your specific needs. This includes the Diamond Scan Series of 14", 16" and 20" autotracking monitors, some with microprocessor-enhanced programmable display settings. All at very competitive prices.

To get a clear view of monitor quality and value, look

to Mitsubishi.

For product information or nearest authorized Mitsubishi Electronics sales representatives, please call 1-800-556-1234, ext. 54M. In California, call 1-800-441-2345, ext. 54M. Mitsubishi Electronics America, Inc., Computer Peripherals Division, 991 Knox Street, Torrance, CA 90502, (213) 217-5732.



EGA Compatible 640 x 350 pixels

						Com	patibil	ity/Re	solution		
Belassiklaki	Screen						Ve	Α£		1024	1280 X
Mitsubishi Model	Size (inches)	Horizontal Scan Frequency (kHz)	Pitch (mm)	NTSC	CGA	EGA	Std.	Ext.	Apple Mac II	768 (48 kHz)	1024 (64 kHz)
Diamond Scan 14 (AUM1381A)	14/13V	15.7 ~ 36 auto-tracking	0.31	•	•	•	٠	•	•		
Diamond Scan 16L* (HL6605TK)	16/15V	30 ~ 64 auto-tracking	0.31				•	•	•	•	•
Diamond Scan 20A (HA3905ADK)	20/19V	15.7 ~ 36 auto-tracking	0.31		•	•	•	•	٠		
Diamond Scan 20L* (HL6905TK)	20/19V	30 ~ 64 auto-tracking	0.31				•	•	•	•	•
XC1429C	14/13V	31.5	0.28				•				
XC1410C	14/13V	22 or 15.75	0.40		•	•					
XC1430C	14/13V	22 or 15.75	0.31		•	•					

<sup>\*</sup>Microprocessor-enhanced programmable display settings



See us at COMDEX Booth #1128

© 1988 Mitsubishi Electronics America, Inc.
Mitsubishi is a registered trademark of Mitsubishi Electric Corp., Tokyo.

Screen images produced with permission from the following companies (trademarked software package name follows compan) name): Autodesk, Inc. (AutoShade); Computervision Corporation (Personal Designer); Computer Friends, Inc. (Modern Artist); SuperMac Software (PokelPain); Three ID (Graphics, Inc. (Perspective); Microsoft Corporation (Excel Version 2.0).

## And Value.

#### REVIEW

#### D THE DATA LANGUAGE

the last transfer field to write the data to the file. Because you have total control over the prompt order, this field may be anywhere on the screen. To avoid problems, the manual advises you to press End to get to the last transfer field, then press Enter to write the data to disk.

You can generate output via print commands or a comprehensive report procedure. PRINT does a reasonable job of providing columnar information with titles, column headings, subtotals, and grand totals, but there is little format control. PON and POFF commands control output that is sent to the printer.

REPORT provides more control over content and appearance via detail, breakpoint, and final (ATEND) sections. Within these sections, conditional processing is supported with IF statements. Data can be calculated, printed, or written to data groups.

From the title and declaratives sections, you can control titles, subheadings, and footers. As with most databases, you can place date, time, and page-number displays within the report. BTITLE enables you to put titles in the body of a report, greatly adding to the flexibility of the report generator.

From a report, you can isolate records to another collection using the SELECT command. This feature can help you reduce the number of times you must process a file to get information. For example, while printing customer statements you can collect all the customers whose balances are over 30 days outstanding. From this collection, you can also print an overdue account list without processing the file a second time.

Via a WRITE statement, you can use a report to update any data group within the database. As with SELECT, this lets you accomplish complex processing with a minimum of overhead.

#### File Importation

DBF, ASCII, data-interchange format, and blocked files can be loaded into D, but there is no automated import. After correctly defining a data group to store the information and a record definition, which defines the file structure to be read, you must LOAD the information. This area in particular is not well documented. It took me four tries and about 30 minutes to transfer my file. Caltex

says it is currently rewriting the documentation for the new version. The company specifically acknowledged the problem with the import/export explanations and advised me that additional material would be available in the new release.

An intuitive relationship exists between data groups whenever they share a common field. Consider a DBD consisting of customers and sales. Viewing the related data is as simple as FINDing the records you want from the sales files and MATCHing the information with customers using the customer number field. The MATCH command locates all records in the sales data group that have customer numbers equal to those in the customer file. There is no limit to the number of data groups that can be matched. And since D does not structure the data files, you need not worry about the related files being indexed on the relate field, as is required in dBASE. D's strength becomes apparent when you use RELATE in conjunction with MATCH. RELATE lets you create one ordered, logical file of the merged data for reports and fully sup-

continued

# BYTE's Subscriber Benefits Program

Your BYTE subscription brings you a complete menu of the latest in microcomputer technology every 30 days. The kind of broad-based objective coverage you read in every issue. *In addition*, your subscription carries a wealth of other benefits. Check the check list:

#### **BONUSES**

- Annual Separate Issues: In addition to BYTE's 12 monthly issues, subscribers also receive our annual IBM PC issue free of charge, as well as any other annual issues BYTE may produce.
- PYTE Deck: Subscribers receive five BYTE postcard deck mailings each year—a direct response system for you to obtain information on advertised products through return mail.
- Reader Service: For information on products advertised in BYTE, circle the numbers on the Reader Service card enclosed in each issue that correspond to the numbers for the advertisers you select. Drop the post-paid card in the mail and we'll get your inquiries to the advertisers.
- TIPS: BYTE's Telephone
  Inquiry System is available to
  subscribers who need fast
  response from advertisers. After
  obtaining your Subscriber I.D.
  Card, dial TIPS and enter your
  inquiries. You'll save as much
  as ten days over the response to
  Reader Service cards.
- Free Programs Via BYTEnet:
  You get access to the BYTEnet
  Bulletin Board Service, which
  allows you to download, via



modem, valuable program listings. There is no connect charge for this service.

- Subscription Service: If you have a problem with, or a question about your subscription, you may call our service department toll-free at 800-423-8272 (in New Jersey call 800-367-0218) during regular business hours (Eastern Time). You can also use Subscription Service to obtain back issues. Should you care to correspond, use the following address: P.O. Box 6821, Piscataway, N.J. 08855.
- ▼ Editorial Indices: Available through our customer service department P.O. Box 328, Hancock, New Hampshire 03449.

#### PAID SERVICES

BIX: BYTE's Information
Exchange puts you on-line 24
hours a day with your peers
via computer conferencing and
electronic mail. All you need to

- sign up is a microcomputer, a modem, and telecomm software. For further information and cost, call 1-800-227-BYTE.
- Program Listings: Listings of programs that accompany BYTE articles are now available on BIX, on disks or in quarterly printed supplements (see reply cards in this issue for cost information), or call 1-800-258-5485.
- Microform: BYTE is available in microform from University Microfilm International in the U.S. and Europe. See Contents page for cost information.

#### DISCOUNTS

- ▼ One-year subscription at \$22.95
- Two-year subscription at \$39.95
- Three-year subscription at \$55.95
- One-year group subscription for ten or more at \$18.95 each. (Call or write for details.)

#### TOLL-FREE NUMBERS FOR YOUR CONVENIENCE:

Subscriptions & Back Issues: 1-800-423-8272 (in N.J., 1-800-367-0218)

BIX: 1-800-227-BYTE

Program Listings Orders: 1-800-258-5485



It's indispensable.



ports one-to-one, one-to-many, many-toone, and many-to-many relationships, all with remarkable ease. By comparison, to process these complex relations in dBASE correctly, you must write code that explicitly tests the conditions.

Options with RELATE let you translate information via an intermediate data group and control the primary sort order for reports. The translation feature lets you use codes as input for speed and reliability, while reports show the appropriate meaning instead of the code.

Variables are defined by the SET command and are accessible everywhere within D. Arithmetic calculations and string concatenation are supported.

**Final Input** 

Where does D fit in the PC database picture? If you're looking to manage a few files, such as a mailing list or parts inventory, the more traditional tools, such as dBASE, are better choices. If the order of your data is always important, the required sorting in D makes it an unacceptable alternative.

D is a viable applications development tool and is especially useful for situations where many people use the database for separate functions. By defining personal interfaces, which are yet another kind of procedure, the developer can show the users only the information they need to know and provide access to only those functions they need to perform. Data security is easier to enforce, because users see only what you want them to see—without ever knowing that more data exists.

Applications that require multiple file updates, as a result of processing, are also a good fit, as are large applications with highly normalized files that exceed the maximum number of open files allowed by DOS.

The flexibility of the data structures, and the ability to order the data when you need it, as you need it, are perhaps most useful for those situations where it is difficult to initially determine all the required operations and reports.

D is different and takes some getting used to. But it allows a high degree of customization and is a good alternative to dBASE for developing custom applications.

Pam Oppenheim is president of Rational Solutions, Inc. (Fort Lauderdale, Florida), an independent software consulting firm involved in the planning, design, and implementation of mini- and microcomputer systems. You can reach her on BIX as "editors."

# Handy scan.

#### Full-Page Scanning In The Palm Of Your Hand.

Mitsubishi Electronics now gives you all the advantages of scanning in a practical size at an affordable price.

Incorporating the 3-in-1 capabilities of handheld, sheetfed and flatbed scanners, the scanner from Mitsubishi® scans up to 8½ inches wide and 14 inches long, at 200 dots per inch resolution.

The scanner recognizes up to 16 gray shades and can scan any photo, text, or illustration in seconds. With the included utility software and controller, the scanner runs with IBM® PC, AT or compatible computers. All for \$995 suggested retail price.

Images scanned can be loaded into popular paint or desktop publishing software packages which support .TIFF or .PCX file formats, such as Aldus® Pagemaker,<sup>™</sup> Ventura Publisher,<sup>™</sup> ZSoft PC Paintbrush® Plus, and many others.

For product information or nearest authorized Mitsubishi Electronics sales representatives, please call 1-800-556-1234, ext. 54H. In California, call 1-800-441-2345, ext. 54H. Mitsubishi Electronics America, Inc., Computer Peripherals Division, 991 Knox Street, Torrance, CA 90502, (213) 217-5732.



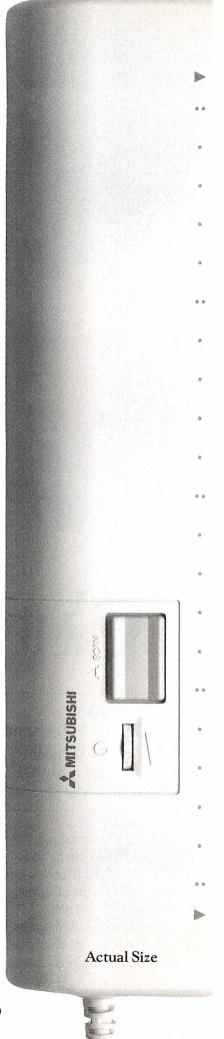
The scanner, model SP-MH216AF, can scan an 8½ " x 11" page in 10 seconds, independently or with its optional automatic paperfeeder, model SP-MH01FA, shown above.

Visit us at COMDEX Booth #1128



#### MITSUBISHI ELECTRONICS

© 1988 Milsubishi Electronics America, Inc. Milsubishi is a registered trademark of Milsubishi Electric Corp., Tokyo. Aldus and PageMaker are registered trademarks of Aldus Corporation. IBM is a registered trademark of International Business Machines Corporation, Ventura Publisher is a trademark of Ventura Sottware, Inc. PC Paintbrush is a registered trademark of ZSoft Corporation.





# Cut your losses.

**Buy MICRO CADAM** CORNERSTONE™ R. 1.3, send us your obsolete PC CAD software, and get a \$1,000\* check from CADAM!

If you've always wanted real mainframe-based CAD power for your IBM<sup>®</sup> PS/2,™ PC/AT<sup>®</sup> or compatible system, here's a sharp new offer from CADAM.®

Buy new MICRO CADAM CORNERSTONE R. 1.3 now. Compare its productivity, ease of use, and mainframebased features with your conventional PC CAD system. (You can go right to work with your existing CAD files, thanks to MICRO CADAM CORNERSTONE's new DXF data translator.)

Then cut up your obsolete software and send us the half with the label, along with your completed rebate coupon and proof of purchase for MICRO CADAM CORNERSTONE R. 1.3. We'll cut you a check for \$1,000.

CADAM's rebate offer is the ultimate deal on the "ultimate PC CAD production tool." But act fast. Rebate expires December 31, 1988. See your dealer today for

qualification details and rebate coupon. For the location of your nearest dealer, phone CADAM toll-free today: 800-255-5710.

MICRO CADAM CORNERSTONE . . . The Ultimate PC CAD Production Tool

Please see us at COMDEX, Booth #4014 and AUTOFACT, Booth #7080

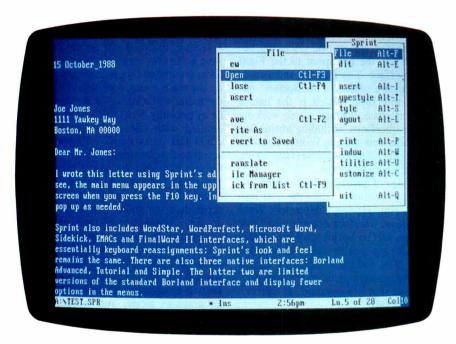


\*This rebate may not be combined with any other special CADAM INC promotion or discounts and is available only in the United States to end users. Certain restrictions apply—see rebate coupon available from your MICRO CADAM CORNERSTONE dealer for details and restrictions. All sales will be verified with dealer of record

CADAM is a registered trademark and MICRO CADAM CORNERSTONE is a trademark of CADAM INC. AutoCAD is a registered trademark of Autodesk, Inc. IBM and PC/AT are registered trademarks and PS/2 is a trademark of International Business Machines Corporation. ©1988 CADAM INC.



# Suit Yourself with Sprint



A high-end word processor that you can customize

Lamont Wood

orland International, the firm that originated the pop-up software genre with SideKick, has come up with another new genre—soft software.

Softness is the whole idea behind Borland's new Sprint word processor, a fullfeatured, top-of-the-line word processing package that you can customize beyond recognition, since the necessary source code and programming language are included with it. It also does a perfectly good job when it comes to producing a document, although it lacks many of the desktop publishing functions offered in other packages. For this review, I ran Sprint 1.0 on a 4.77-MHz Eagle PC with 640K bytes of RAM and a 20-megabyte hard disk drive.

#### Different by Design

Borland touts Sprint as a word processor with multiple interfaces. This multiple interface capability is actually a product of Borland's design philosophy-Sprint

isn't just a word processing program; it's also a macro-based programming language designed for writing word processing programs. Its verbs and syntax are reminiscent of C. When you run Sprint, you're actually running a program in what Borland calls the "Sprint macro language." Unlike the macro capabilities of other word processors, Sprint goes beyond printer file and keyboard interface modification to let you alter or rewrite any part of the program.

Sprint includes the source code for its macros. Once you find and unpack them from an archive file on one of the distribution disks, you can load them into Sprint as word processing documents and then study, modify, compile, and use them. Complete documentation for the macro language is included.

The language is specially designed for writing word processing applications; its verbs deal mostly with text and menu manipulation. It also has global and local variables and conditional statements, and there's an interesting menu verb that handles displaying a pop-up menu and executing whatever command the user picks from the menu list.

It's fairly simple to load the source code for the user interface and change key assignments: You simply load and edit the source code as you would any other word processing document. For instance, if your sloppy typing makes it advisable to eliminate the command assignment for Control-A, you can load the source file (SP.SPM) and find the list of keyboard assignments using the Find command; you'll see ^A : WordBack. You replace WordBack with Null, save the file, and then load it as a macro definition, so that when your left hand slips, nothing happens.

You could also use the Sprint macro language to write your own word processor from scratch. But budding word processor programmers had best take note—the source code for the main Bor-

#### Sprint 1.0

#### Type

Word processor

#### Company

Borland International 1800 Green Hills Rd. P.O. Box 660001 Scotts Valley, CA 95066 (800) 543-7543 (408) 438-8400

#### **Format**

Eleven 51/4-inch floppy disks; 31/2-inch floppy disks available

#### Language

C

#### **Hardware Needed**

IBM PC or compatible with 384K bytes of RAM and two floppy disk drives or a hard disk drive

#### **Software Needed**

DOS 2.0 or higher

#### **Documentation**

362-page User's Guide 388-page Advanced Reference Guide 504-page Advanced User's Guide 32-page Alternative User Interfaces

#### **Price**

\$199.95 \$595 for five-user network license

Inquiry 891.

land interface macro is 73K bytes long. Word processor programming is not a trivial task.

Sprint also comes with some interesting canned macros (invoked through the Potpourri menu) for things like "transpose letters" and "delete next paragraph." You can either call them up from a menu or assign a keystroke to each one and invoke them automatically.

Presumably, you could keep adding macros and eventually rewrite Sprint to something that exactly suits your tastes. You could have Sprint automatically do a lot of little chores, like stripping out the Return for next line prompts that always sprinkle everything you download from certain electronic mail services—or you can create entire programs, such as a text database for handling filing tasks (see listing 1). But Borland is selling Sprint as a word processor, not a programming language, so the package

should stand on the merits of its word processing features.

#### **Abundant Interfaces**

As shipped, Sprint 1.0 is bundled with nine interfaces: Microsoft Word, Word-Perfect, WordStar, SideKick, Final Word II, EMACS, Borland Tutorial, Borland Simple, and Borland Advanced.

The first three interfaces offer compatibility with the leaders in the word processing market, so their inclusion is to be expected. SideKick is a Borland product. Borland produced Sprint by acquiring, rewriting, and enhancing Mark of the Unicorn's Final Word II, so Final Word's interface was included. EMACS, a mainframe editor, was included because it was the precursor to the Final Word interface. The Tutorial and Simple interfaces are subsets of the Borland Advanced interface, which is the native Sprint interface. Borland is also working on other interfaces, including MultiMate Advantage and DisplayWrite. You can also create your own interface using Sprint's macro language.

The idea of having multiple interfaces seems to be simply to ease the user into using Sprint. Having a Microsoft Word or WordStar interface doesn't mean that when you call up Sprint you'll be tricked into thinking you're using those programs. The interface basically covers keyboard reassignments and custom popup menus that are overlaid on Sprint's main structure.

Borland makes no attempt to clone the "look and feel" of the target software. It simply attempts to help users, habituated to one of these word processing programs, to get up to speed with Sprint by emulating the function keys and key combinations these programs use.

For instance, when using the Microsoft Word interface, that program's command menu doesn't suddenly appear along the bottom of the screen. Instead, Sprint's one-line shaded status line appears there. But when you press Escape, a pop-up menu appears that lists the commands you would normally see on the bottom of the Word screen, and the function keys have the same effects they would have if you were using Word. If you choose to load more than one interface during the installation procedure, you can switch between them while editing a document.

For the perplexed, there's a command that gets you an on-screen diagram of the assignment of the function keys, and a macro prints a quick reference card for whatever interface you're using. The Alternative User Interfaces booklet that

comes with the documentation covers the basics for each.

Sprint stores files in its own format, which is ASCII with embedded control characters, no matter which interface you use. But it does include translation facilities to convert to and from ASCII, DisplayWrite 4.0 (and other IBM Document Content Architecture-formatted files), Microsoft Word, MultiMate 3.3, MultiMate Advantage, WordPerfect 4.0, and WordStar. You can also import Side-Kick Plus Outlook outline files, but you can't export them back to SideKick.

#### The Native Interface

The Borland Advanced interface has several ways of doing almost anything. To save a file, for instance, you invoke the Save command by pressing F10 to bring up the main menu, and then you scroll to the menu's File item (via the cursor keys or by pressing F) to call up the submenu dealing with file commands. (Or you could just press Alt-F.) You press S to scroll to the Save entry on the submenu. Or you can skip the whole process and just press Control-F2. Alternately, you could edit the interface macro as described earlier so you can invoke it with any key combination you select.

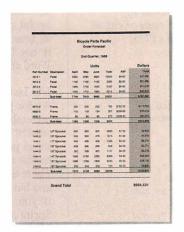
Meanwhile, on the screen, what you see is *not* what you get, and it may not even be approximately what you get when you're doing fancy formatting, such as columns or footnotes. Sprint has no graphics mode, and the screen displays straight text with embedded commands. Changing to multiple columns or changing font sizes has no apparent effect. You simply see a highlighted BEGIN COLUMNS2, for instance, if you go to a two-column page.

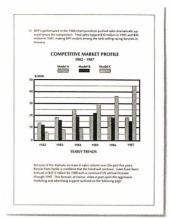
You can change fonts through the Typestyle selection on the main menu. Since the process of installing Sprint involves specifying which printer (and font cartridge, if applicable) you're using, Sprint knows what typefaces are available and presents you with a list. To change to, say, 14-point Helvetica Bold (having installed the B cartridge on a LaserJet Plus or equivalent), you'd invoke the Font command under the Typestyle command and pick HelvBold from the list. The boldfaced command FONT HELVBOLDENDF appears with the cursor under the E in ENDF. All text positioned between HELVBOLD and ENDF appears in Helvetica Bold.

The Customize Screen option replaces the highlighted screen commands with the actual control characters Sprint uses. This helps to diagnose formatting prob-

## How to look good from start...









### to finish.

#### The HP LaserJet Series II Printer.

Nothing brings your ideas to life like the HP LaserJet Series II Printerfrom office memos to forms

to newsletters. As the leading laser printer, it works with all popular PCs and PC software packages. And, with a wide range of fonts, you get more options to create superior looking documents.



With additional memory you can even print sophisticated 300 DPI full-page graphics. And with HP's ScanJet scanner, you can also easily add photographs,

illustrations and text.

No wonder more people choose the original over all other laser printers combined.

So call 1800 752-0900, Ext. 900D for your nearest HP dealer.



© Hewlett-Packard 1988

Print samples were created using Microsoft Word, Microsoft Excel, and Aldus PageMaker.

Listing 1: This simple macro provides a look at Sprint's macro language. The routine formats a Sprint text file for use with Ventura Publisher by replacing quotation mark characters (ASCII 34) with printers' open or closed quotation marks (indicated in Ventura Publisher as <169> and <170>, respectively).

```
Ventura:
                               ; Name of macro.
 while (34 csearch) {
                               ; Search for ASCII
                               ; 34 (") occurrences and
                               ; when found move forward
                               ; one character.
  if istoken
                               ; If the new position is
                               ; part of a word,
     (r c del insert "<169>") ; back up, delete the ", and
                               ; insert <169>.
                               ; Or, if the position is not
  else
                               ; part of a word,
     (r c del insert "<170>") ; back up, delete the ", and
                               ; insert <170>.
                               ; This } ends the "if true"
                               ; condition for the search.
  r toend
                               ; Means "reverse to end"
                               ; (i.e., go to top of file).
```

**Table 1:** Benchmark results for Sprint versus Microsoft Word and WordPerfect. The use of a mouse with Microsoft Word and Sprint gives both programs an advantage on the keystroke count test. All times are in seconds.

Sprint 1.0	Microsoft Word 4.0	WordPerfect 4.2
160	158	246
46	24	8
1	<1	<1
11	1	7
17	5	12
101	160	90
32	35	89
1	3	2
3	6	4
	160 46 1 11 17 101 32 1	Word 4.0  160 158 46 24 1 <1 11 1 17 5 101 160 32 35 1 3

lems. For example, in one document I created, I found that strange blank spaces and randomly positioned capital letters showed up in my printouts. Using the Customize Screen option, I discovered stray control characters in the file left over from my previous editing sessions. I deleted these, and the problem went away. Switching to control-character mode makes the text hard to read, however; tabs, for example, show up as ^I, and the actual tab spacing disappears.

To get an idea of what your text looks like without actually printing it, you can use the Preview command. This formats the text as if Sprint were printing it, with headers, footers, and margins displayed on the screen. But the text has the same fixed size and spacing that the raw text on the word processing screen has. So if

you change to an 8-point proportional font, for example (so that a lot more text can fit on a line), the text on the preview screen doesn't change size. Since the character size remains the same on the screen, and the margins stay the same, where does all the extra text go?

The preview screen formats the text so that it shows the material that is flush against either margin, and the extra text drops from the middle of the line. Except for the first and last words of each line, the material is gibberish. There's no harm in this, since the point is to see how the page is laid out, but it's a bit disconcerting the first time you see it.

According to Borland, a version that supports graphics mode is in the works and will run under OS/2's Presentation Manager. Borland says that it avoided

graphics for version 1.0 in order to make the software useful on a broader range of hardware and to enhance performance. Sprint does, indeed, respond well, and its benchmark results were respectable, if not blazing, compared to Microsoft Word and WordPerfect (see table 1).

#### I/O Issues

As for printed graphics, Sprint lets you use embedded commands to print Encapsulated PostScript Format (EPSF) graphics as part of a document, but it doesn't handle any other kinds of graphics files. There are also commands to draw lines and bars, but these, likewise, work only if you are using a PostScript printer. Sprint also makes provisions for using a Microsoft Mouse.

Sprint includes a 100,000-word spelling dictionary and a 25,000-root-word thesaurus. The dictionary has an autospell feature that you can set to beep when you misspell a word. The autospeller actually kept up with my typing (about 80 words per minute), and I found the instant feedback valuable.

Also included is a mail-merge facility for generating form letters, an outliner, style sheets, and a glossary facility for capturing and replaying keystroke sequences. There are commands for creating indexes, which are dynamic (i.e., they follow page-numbering changes).

You can configure Sprint to save text automatically—it updates your changes to a separate "swap" file every time you stop typing for at least 3 seconds, so that a power outage or forgetting to save the file won't cost you a day's work. Sprint automatically retrieves unsaved changes from the swap file each time you call up the document. You can also set the interval between disk updates to any number from 0 (no update) to 60 seconds. This process is transparent; it doesn't snag the keyboard or the display, and the only evidence that shows it occurring is the disk indicator light.

You can have up to six windows open on the screen at one time, each containing either different documents or different parts of the same document, and you can shift text between windows. Each window stretches all the way across the screen, but the vertical size is adjustable and can be as shallow as one line.

The documentation—a softbound user's guide, an advanced user's guide, a reference guide, and an alternative user interfaces booklet—is thorough. However, Sprint's help screens are all that most users will need to get up and running. Also, while each book has an in-

# Small cash input for laser-quality output.



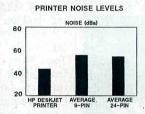
hp HEWLETT PACKARD

Dear Reader:

This letter was printed on one of the finest printers available

The HP DeskJet Printer.

It prints text and graphics more crisp and clear than 24-pin printers. And as you can see from the chart, it's a lot quieter than 24-pin printers, too.



It's also easy to use. It does your important office tasks, but it's small enough to fit on your desk. Everything considered, it's the perfect personal printer.

And one of the most amazing features of all is its price. It's under \$1,000.

Call us for the name of your local HP Dealer at 1 800 752-0900 Ext. 908B. Then go see for yourself why we call it laser-quality

Richard Snyder

### The HP DeskJet Printer. Laser-Quality Output for Under \$1000.



#### SUIT YOURSELF WITH SPRINT

1	Exxon	25	Standard Oil (Ohio)	49
2	General Motors	26	AT&T Technologies	50
3	Mobil	27	Boeing	51
4	Ford Motor	28	Dow Chemical	52
5	IBM	29	Allied	53
6	Texaco	30	Eastman Kodak	54
7	E.I. du Pont	31	Unocal	55
8	Standard Oil (Ind.)	32	Goodyear	56
9	Standard Oil of Cal.	33	Dart & Kraft	57
10	General Electric	34	Westinghouse Elec.	58
11	Gulf Oil	35	Philip Morris	59
12	Atlantic Richfield	36	Beatrice Foods	60
13	Shell Oil	37	Union Carbide	61
14	Occidental Petroleum	38	Xerox	62
15	U.S. Steel	39	Amerada Hess	63
16	Phillips Petroleum	40	Union Pacific	64
17	Sun	41	General Foods	65
18	<b>United Technologies</b>	42	McDonnell Douglas	66
19	Tenneco	43	Rockwell Int.	67
20	IΠ	44	PepsiCo	68
21	Chrysler	45	Ashland Oil	69
22	Procter & Gamble	46	General Dynamics	70
23	R.J. Reynolds Ind.	47	3M	71
24	Getty Oil	48	Coca-Cola	72

49	Consolidated Foods
50	Lockheed
51	Georgia-Pacific
52	Monsanto
53	W.R. Grace
54	Signal Companies
55	Anheuser-Busch
56	Nabisco Brands
57	Johnson & Johnson
58	Coastal
59	Raytheon
60	Honeywell
61	Charter
62	General Mills
63	TRW
64	Caterpillar Tractor
65	Aluminum Co. of Amer.
66	Sperry
67	Gulf & Western Ind.
68	Continental Group
69	Bethlehem Steel
70	Weyerhaeuser
71	Ralston Purina
72	Colgate-Palmolive

### 27 million Americans can't read. And guess who pays the price.

While American business is trying to stay competitive with foreign companies, it's paying an added penalty. The penalty of double-digit illiteracy.

Believe it or not, 27 million American adults can't read and write. Another 47 million are literate on only the most minimal level. That adds up to almost one third of our entire population...and probably a disturbing number of *your* employees.

What does illiteracy cost you? Get out your calculator. Illiterate adults make up 50%-75% of our unemployed. Every year they cost us an estimated \$237 billion in lost earnings. They swell our welfare costs by \$6 billion annually and diminish our tax revenues by \$8 billion.

Illiteracy costs you through your community, too. It robs the place where you work and live of its resources. It undermines the potential of the people who make your products and the people who buy them. No dollar figure can be assigned to this. But over the years, this may be the costliest loss of all.

What can your company do about this? It can join in local efforts to fight illiteracy. It can volunteer company dollars and facilities for better school and tutorial programs. It can invest in a more literate community.

The first step is to call the Coalition for Literacy at 1-800-228-8813 or fill out the coupon below. Do it today. You may find it's the greatest cost-saving measure your company has ever taken.

### A literate America is a good investment.



		he Coalition	for Literacy
Please nave	a representative of	contact me	
Name			
Title			
Company			
Address			
C+ty		State	Z <sub>1</sub> p
Phone			
Please return to	Coalition for Literal Business Division PO Box 81826 Lincoln, NE 68501		

dex, the documentation could use a central index. There's no hint in the user's guide of advanced features, such as column formatting, which are discussed in the reference guide.

#### Run for the Money

Seen from a programmer's viewpoint, Sprint is a delight. Seen from a typist's viewpoint, however, it offers nothing new. Sprint's most unique feature is its programmability. But how many typists want to write their own user interfaces? And even experienced users are more likely to cringe than salivate when presented with yet another programming language.

Putting programmability aside, Sprint offers most of the features of its competitors and is adequate. However, it doesn't share the aspiration of the current generation of word processing programs: adding desktop publishing functions (see "Word Processors for Desktop Publishing" in the May BYTE). For example, Total Word can capture screen graphics from other programs, and MASS-11 supports Lotus PIC, Hewlett-Packard Graphics Language, and EPSF files. By contrast, Sprint has no graphics mode, supports only PostScript graphics files, and you can create only lines and boxes with it. It also has no redlining, scientific equations, on-screen math, or other recent offshoots of the word processing features checklist wars.

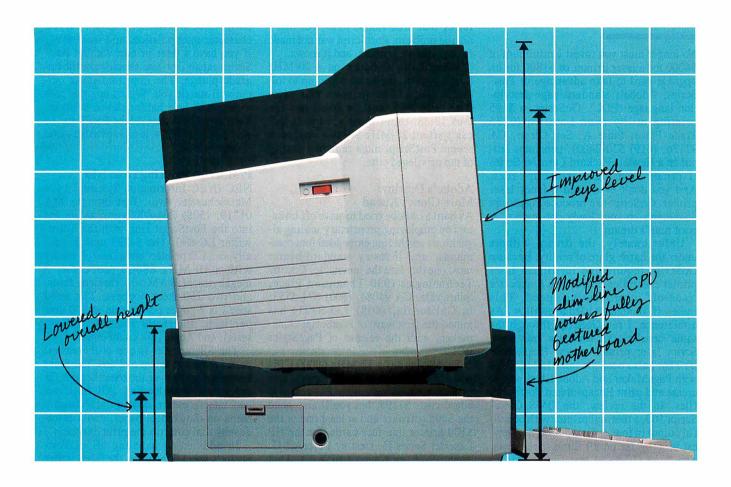
On the other hand, at \$199.95, Sprint is far less expensive than its rivals. It's a no-risk word processor that's so easy to use that anyone brought in from a temporary office help agency could pick it up immediately. Sprint's multiple interfaces could also help users that are familiar with different word processors to standardize on one word processing file format without having to learn a new keyboard interface.

If your word processing needs are more sophisticated and you're willing to do some programming, Sprint is a word processor you can ultimately adapt to any project. If you want a word processor with capabilities that push the limits of technology, Sprint won't fit the bill. But if desktop publishing functionality isn't essential, or if you want a word processor you can alter to match your needs, then Borland has something for you.

Lamont Wood is a freelance writer in the computer and electronics fields and lives in San Antonio, Texas. He has been using word processors professionally for more than 10 years. He can be reached on BIX as "lwood."

# **New Corporate Profile.**

This is the remarkable new, AT™compatible, TCS-4000. Like today's most successful corporate executives it's slim, effective, ready to do what has to be done...and then some.



Thanks to an advanced design, and the advanced manufacturing techniques needed to turn design into hardworking reality, the TCS-4000 is an ideal computer for even the most demanding corporate system requirements. Yet, its price is such that it can easily and effectively serve as a workstation.

Key to the TCS-4000's enormous capabilities, flexibility, and value is its sophisticated, fully featured motherboard. It allows you to quickly, simply, make the TCS-4000 part of a network. In short, the TCS-4000 is a complete computer. There's little need to worry about selecting components and peripherals.

The TCS-4000, and its motherboard, features an 80286, 10MHz, micro-processor, 640KB RAM...expandable to 1MB, 2 I/O slots (all that's needed

since the motherboard includes floppy and hard disk controller, parallel and serial ports, and an EGA adaptor), and a host of other features that add up to enormous capabilities.

At Tatung, the measure of technology is not how big it is, but how hard it works. The new TCS-4000 measures up. For complete details,

call today.



Advanced thinking is an ancient art. West (213) 979-7055 — Mid-West (817) 640-3175 East (609) 395-6770

Tatung Company of America, Inc. 2850 El Presidio Street, Long Beach, California 90810 Tatung Science & Technology, Inc. 2060 Ringwood Ave., San Jose, CA 95131

All trademarks are property of their respective manufacturers.

# Review Update

#### Poor Man's PostScript

No longer must you invest a minimum of \$4000 for a laser printer or \$1800 for an upgrade card to take advantage of Post-Script, Adobe's standard page-description language (PDL). GoScript, a \$195 printing utility from LaserGo (9235 Trade Place, Suite A, San Diego, CA 92126, (619) 530-2400), generates output on a Hewlett-Packard LaserJet Series II printer from most PostScript files. And you don't even need a fancy laser printer. GoScript can produce PostScript documents on your lowly dot-matrix. A poor man's dream!

Unfortunately, the dream withers under the harsh glare of reality. Because GoScript requires no intelligent laser printer controller board, you'd expect a trade-off in processing speed. This trade-off, though, is hard to swallow. As a reference, I ran GoScript through the same benchmarks used for our Post-Script laser printer review (September BYTE). I also used the same IBM PC AT with PageMaker and Adobe Illustrator to create and print Encapsulated PostScript files. In the review, the QMS Color-Script 100, a thermal printer with beautiful output in four colors, posted the slowest time by far on all three speed tests. The large (30-page) text file printed in 26:22 (minutes:seconds); the small (6page) text file printed in 6:02; and the 1-page graphics file printed in 4:57.

I started the tests by booting GoScript and sending the large text file to a dot-matrix printer. Four pages and 90 minutes later, I aborted. The small text file poked through in 22:15, and the 1-page graphics file took 15:40. I thought the throughput times might improve when printing to the LaserJet, but they actually got worse. The graphics file, for instance, took 35:05.

For \$195, you may be willing to live with slow-motion throughput, but it'll be even harder living with the output. The dot-matrix printout approached illegibility, and the laser output, though much better, did not support special-effects features (e.g., rotation and shadowing).

GoScript uses Bitstream outline fonts rather than true Adobe fonts, but that's not the problem. PostScript was not made for dot-matrix printers, and it shows.

When I ran GoScript on a 20-MHz 80386 system, the times edged up to tolerable limits. The graphics file came through at 3:03, and the small text file took 13:38. Unfortunately, us poor folk can't afford 20-MHz 80386s. And so it seems PostScript must remain a luxury of the privileged elite.

#### Adobe's Destiny: More Clones Ahead

As hard as Adobe tried to stave off imitators by employing proprietary scaling algorithms and hiding embedded font commands, any industry standard-bearer must one day face the inevitable. Destiny Technologies (930 Thompson Place, Sunnyvale, CA 94086, (800) 874-5553; in California, (408) 733-3171) has joined the first wave of PostScript clonemakers with the release of PageStyler PDL.

PageStyler has a 12-MHz 68000 CPU and 2.5 megabytes of RAM (upgradable to 4.5 megabytes). The PC-resident board costs \$1195, but you'll also need the \$495 software and at least one of the \$100 printer interface cards (for the HP LaserJet Series II, Destiny LaserAct II, Acer LP-76, or Canon LBP-8 II). That still adds up to a significant savings over true PostScript boards. The software includes 13 base fonts. Options include an additional 22 downloadable fonts and a memory upgrade.

The PageStyler software took a while to load (4:26), but you can set up your autoexec file to do that. The large text file printed in 8:27, at the bottom of the heap compared to other PostScript printers or even true PostScript boards such as the JetScript (\$2495). However, PageStyler handily beat out PC Publisher's Kit, a PostScript clone we tested in September. The small text file printed in 1:59. Only the ColorScript was slower than that. PageStyler also came up slow on graphics throughput, posting a time of 4:12.

PageStyler, despite its slowness, did produce high-quality output. Destiny selected Bitstream fonts over the Adobe versions, but the differences between the two, though noticeable, are not flagrant. PageStyler performs all the slick Post-Script effects: shading, rotation, curves, character manipulation, and shadowing. If you have a laser printer without Post-Script capability, you should take the upgrade plunge. The improvement in output will startle you. Which upgrade path to take will be a harder choice to make. You can go with true Adobe PostScript or you can opt for a less expensive—and slower—clone.

#### PostScript Printing from NEC

NEC (NEC Information Systems, 1414 Massachusetts Ave., Boxborough, MA 01719, (508) 264-8000) throws its hat into the PostScript ring with the Silent-writer LC-890. The \$4795 unit is actually an LED printer, not a laser. It comes with a 10-MHz 68000 processor, 3 megabytes of RAM, 35 resident fonts, and two 250-sheet hoppers. The rated speed is 8 pages per minute at 300 dots per inch. Interfaces include parallel, serial, and AppleTalk connections.

The Silentwriter is one of the easiest page printers to set up and use. The toner cartridge snaps over the toner hopper for quick and clean loading. All functions and interfaces are configurable from a menu on the control panel, and a print-density dial controls the print darkness.

In addition to handling all of Post-Script's special features, the Silentwriter produces exceptional print with particularly smooth gradations. NEC has gone with the real thing: true PostScript (version 47) and licensed fonts from Adobe.

The printer is slow, though. It came out near the bottom on all three of the AT speed benchmarks when compared to the printers reviewed in September. The large text file printed in 5:59, the small text file in 1:37, and the graphics file in 3:03. The Silentwriter did much better on the Macintosh side, placing among the upper half of those printers tested. Interfacing through AppleTalk, the Silentwriter registered times of 7:40 on the large text file, 1:30 on the small text file, and 1:57 on the graphics file. Despite slow times, this is a solid product and a good buy.

—Stanford Diehl Testing Editor, BYTE Lab



VGA provides significantly higher resolution. In fact, image clarity is 37% higher than EGA. And while EGA gives you 16 on-screen colors, VGA puts 256 colors (from a palette of 262,144 colors) on a monitor's screen at a time. Distortion, ghosting, and even eye fatigue is sharply reduced. In text modes, characters (even those with descenders like y, p and g) are more clearly defined thanks to a 9 x 16 dot matrix. But, while the monitor is a vital part of a VGA system, we think the real key is the VGA card that goes with it.

with a single high speed, register compatible, VGA chip...a graphics controller that's incredibly fast (it has a bandwidth more than 7 times that of other VGA boards)! You can access this speed through the 16-bit data path to display memory, BIOS ROM, and I/O. Our exclusive SwiftWrite makes the wait state virtually non-existant. More? With 16 colors, resolution increases to 800 x 600. On-board is a 256K DRAM; and the card is backward compatible with EGA, CGA, MDA and Hercules graphics standards.

monitors. Each model provides 640 x 480, 640 x 350 lines of graphics resolution; 720 x 400 lines for text. Tatung's new VGA monitors offer a broad range of features that contribute to their superior value: dark, non-glare CRT's, automatic vertical sizing encoding, multi-color text or reverse video switch, 110/220V switchable power supply, removable tilt/swivel bases...all supported by Tatung's full year warranty.

cases, the Tatung VGA bundle will cost no more than EGA packages! That's why we believe that feature for feature, dollar for dollar, the Tatung VGA bundle represents incomparable value. The kind of value only the largest manufacturer of monitors in the world can deliver.

In addition, Tatung offers users a huge advantage: a Tatung VGA bundle is 100% IBM,TM VGA compati. ble and more...your investment in software is fully protected.

guarantee\*: if you note any software incompatibilities within the 1 year warranty period, Tatung will correct them free of charge within 30 days, otherwise the full value of the Tatung VGA card will be refunded.

That's the Tatung VGA story. It's a story worth seeing. For complete information, specifications, and the name of the Tatung dealer near you, and to arrange for a demonstration, call us today. After all, seeing is believing.



We monitor the world. (213) 979-7055

West: Mid-West: (817) 640-3175 East: (609) 395-6770

Tatung Company of America, Inc.

2850 El Presidio Street Long Beach, California 90810

### ... With a 10 Day Trial Membership

If you've thought about joining **BIX** before but weren't sure it was what you needed, now is the time to try it. Because now for a limited time, we're inviting you to try **BIX** for 10 days. If at any time during this 10 day trial period you don't feel **BIX** has made you a more knowledgeable microcomputer user, we'll refund your entire registration fee. You pay only for time spent on the system.\* (See log-on instructions for hourly rates).

Explore **BIX** in your home or office. Put its power to work for you and unleash your full microcomputer potential — programming, designing, specifying, researching — and more.

Try **BIX** for 10 full days and see what it can do for you. Explore more than 160 conferences. Access vendor support. Speak to expert consultants. Research new products and systems, and download public domain software.

#### Prepare yourself for success

It takes a sharp mind and hard work to stay ahead, and having the right tools helps.

Today, you can put one of the most powerful instruments for career advancement to work for you: **BIX.** 

- Learn about new products before they hit the market.
- Get quality marketplace feedback on the products you're thinking of purchasing before you invest.
- Research problems and find the solutions that no one else has been able to render.
- Access some of the most advanced public domain software available in the industry.
- Increase your working knowledge of micros to make more confident purchasing decisions and recommendations.

#### Join BIX and arm yourself with the latest in microcomputerrelated information

**BIX**'s exclusive *Microbytes* newswire gives you complete, daily, up-to-date computer industry information. You'll gain insight from BYTE editors and writers who analyze new products and their potential impact, inform you of the latest mergers and acquisitions, and report late-breaking news from important seminars and conferences.

#### Talk to colleagues worldwide

You'll stay on top of your company's

business with **BIX**'s electronic mail service.

"Talk" to your east coast, west coast
— even European — contacts all in the same day.

Or, simply communicate with other **BIX** users worldwide. Share information and ideas privately, or in conference.

# Choose any option for online access with a one time \$39 membership fee

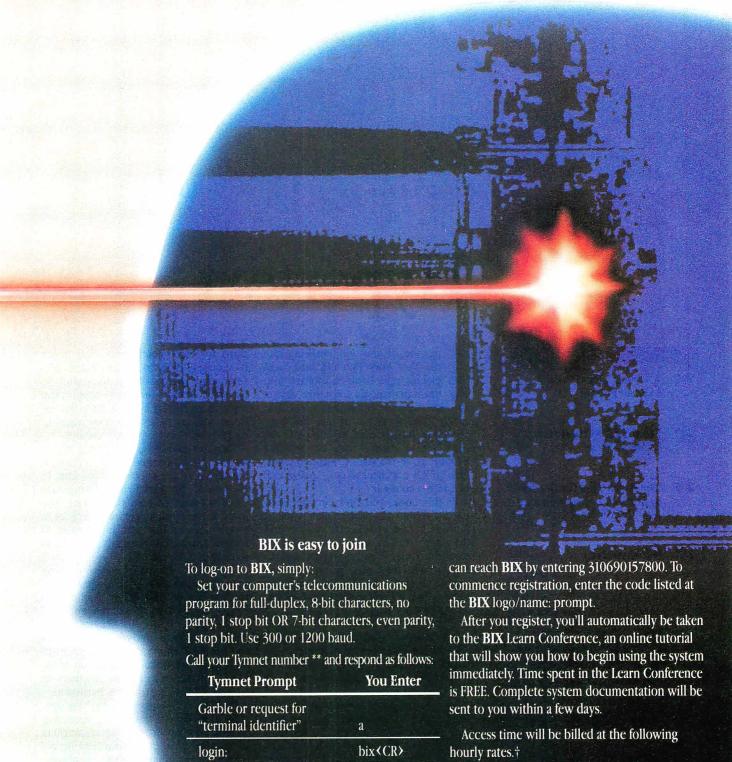
- Use MasterCard, VISA or American Express and begin your 10 day trial use of BIX right now.
- The 10 day trial also applies if you open an individual pre-paid account on BIX. Trial commences once we open your account and notify you.
- Other billing options including qualified corporate accounts are available. (Sorry, our 10 day trial is not available for these accounts.) Call or write BIX for details.

Use credit cards for immediate access or call the **BIX** Helpline for information on any other payment option at, 1-800-227-2983 (from U.S. and Canada) 603-924-7681 (in New Hampshire and elsewhere).

Act now! Our 10 day trial offer is subject to cancellation at any time.

<sup>\*</sup>To notify BIX that you wish to discontinue service at any time during the trial period, call the BIX Helpline, and your entire membership fee will be refunded.

<sup>\*\*</sup>BIX can be accessed via Tymnet throughout the U.S. and Canada. For the Tymnet number nearest you, call the BIX Helpline or Tymnet at 1-800-336-0149. †If your local Tymnet number is a toll call you will receive additional charges from your local phone company at their prevailing rate. ††Continental U.S. Tymnet rates. Rates from other areas are available from BIX.



bix.038 ⟨CR⟩

BIX logo/name:

Callers outside the U.S. who have a communicat-

ing computer or terminal and a packet switching

account with their host country phone system

Off-Peak Time \$11/hr. (\$9 BIX, \$2 Tymnet)††
(7 PM – 6 AM weekdays, all day weekends and bolidays)
Peak Time \$20/hr. (\$12 BIX, \$8 Tymnet)††

(6AM – 7 PM weekdays)



One Phoenix Mill Lane Peterborough, NH 03458

# Hypertext

- **A Grand Vision** by Janet Fiderio
- From Text to Hypertext 247 by Mark Frisse
- 255 The Right Tool for the Job by Michael L. Begeman and Jeff Conklin
- **Hyper Activity**

magine, if you will, walking into the New York Public Library and picking up a book on Mozart. You begin to read and learn that Mozart was an Austrian composer in the late 1700s. You wonder what else was happening in Austria then, so you go to the card catalog, find a book on Austrian history, go to the stacks, locate the volume (if it's not checked out), and read it before you continue.

In this book, you find a reference to old Salzburg, and you wonder what it looked like. Back to the card catalog, and the stacks, to find a book with images from that time. Finally, you get back to Mozart and read of a piano concerto you've never heard. This time you head for the library's record collection and listening room.

This process continues until you have either satisfied your desire for knowledge on the subject or worn yourself out searching for it, whichever comes first.

Now imagine sitting at your computer and bringing up a hypertext system on music. You begin to read about Mozart. When you wonder about Austrian history, you simply highlight the text and request more information with a mouse click or a few keystrokes. To find images of old Salzburg, you use the same process. And to hear the piano concerto? The same.

Sounds a lot simpler, doesn't it? The only restriction to this seemingly endless fountain of knowledge is that the author of the hypertext system had to establish the connections for you to follow and provide the additional knowledge for you to retrieve.

In the article "A Grand Vision," Janet Fiderio delves into the mysteries of hypertext: where it came from (Ted Nelson's Xanadu and Douglas Engelbart's NLS), where it is now (Guide and HyperCard for microcomputers), and where it's going (CD-ROM). Janet describes its form and various functions, such as browsing, nodes, and links—aspects that separate hypertext systems from normal databases—as well as the two main directions of recent hypertext research.

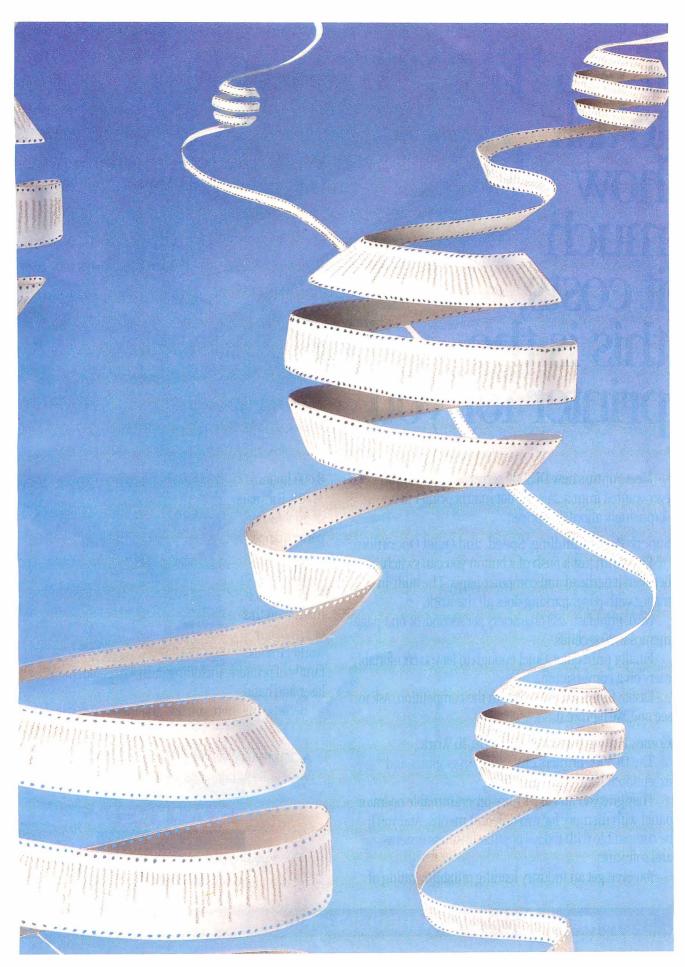
One of these directions, using hypertext for great libraries of information, is the thrust of the article "From Text to Hypertext" by Mark Frisse. To organize large volumes of textual material, you must convert and structure quantities of (hopefully) on-line text into hypertext format. Mark deals with this process and its attendant problems.

The other research direction is using hypertext as an aid to problem resolution. In their article "The Right Tool for the Job," Michael L. Begeman and Jeff Conklin describe the gIBIS system's approach to system analysis. This system provides a framework within which to present issues, take positions on those issues, and argue with those positions—a framework for constructive discussion.

Finally, in "Hyper Activity," we provide a variety of resources, including some current hypertext products, various educational institutions involved in hypertext research, and a short, noninclusive reading list.

As the mass of knowledge we all must assimilate in this multifaceted world of ours continues to grow, from Mozart to microcomputers, the future of hypertext systems looks bright indeed.

> —Jane Morrill Tazelaar Senior Technical Editor, In Depth





Meet Fujitsu's new DL3000 series printers. All you ever wanted from a 24-wire dot matrix printer at a surprisingly affordable price.

#### Superb Paper Handling, Speed, and Quiet Operation.

First, with just a push of a button you can switch between letterhead and computer paper. The built-in tractor with paper parking does all the work.

Next, print fast. 288 characters per second, or one-page memos in 10 seconds.

Finally, print quiet. Quiet enough to let you comfortably carry on a conversation.

Easier, faster and quieter than the competition. Ask to see one. We'll prove it.

#### Comes Fully Loaded, Ready To Go To Work.

The DL3000 printers give you crisp graphics and exceptional letter quality printing.

They give you an easy-to-use programmable operator panel with memory for two different menus. And you'll be compatible with today's popular business systems and software.

You even get an industry leading reliability rating of

8,000 hours MTBF. For years of trouble-free performance.

Call 800-626-4686 today for more information on this or any of our world famous

DEGODO (MARITON	Carriage, DESAUU	anino Carriago)	
Speed	High Speed Draft Draft Quality Letter Quality	288 cps at 12 cpi 216 cps at 12 cpi 72 cps at 12 cpi	
Fonts	Courier 10 Prestige Elite Compressed Optional Font Card	with 2 Fonts per Card	
Paper Handling	Standard Push Tractors with Automatic Sheetloading and Paper Parking; Optional Single and Double Bin Cut Sheet Feeders		
Acoustic Noise	55 dBA		
Interfaces	Centronics Parallel	or RS232C Serial	
Emulations	IBM® Proprinter XL,® IBM Graphics Printer,® Diablo 630® API, Epson JX80® (with Color Option)		
Color Option	User Installable Kit		
including	daiorry bool d	ot mantaire	

family of printers, including daisywheel, dot matrix, laser and band.

Because the more you ask, the more we can do for you.

DI 2200 (Narrow Carriago) DI 2400 (M

#### A COMPANY WITH CHARACTER AND DRIVE



FUJITSU AMERICA

Computer Products Group

FOR MORE INFORMATION ON THE DL3000 SERIES PRINTERS, CALL 800-626-4686

#### **HYPERTEXT**

# A Grand Vision

Hypertext mimics the brain's ability to access information quickly and intuitively by reference

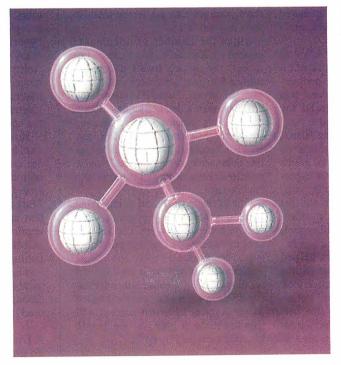
#### Janet Fiderio

or 1945, the vision was a grand one: an on-line text and retrieval system that contained not only post-war scientific literature but also sketches, photographs, and personal notes. The machine, called a memex, would let you browse and make associative links between any two points in the library. You could then record and traverse them at will.

Vannevar Bush, President Roosevelt's science advisor and overseer of all wartime research, including the Manhattan Project, envisioned, yet never created, the mechanism. It became the foundation for all hypertext systems. (See the text box "The Pioneer Spirit" on page 238.) Now, 43 years later, hypertext applications are finding their way out of the research laboratories and into the market.

What Is Hypertext?

Hypertext, at its most basic level, is a DBMS that lets you connect screens of information using associative links. At its most sophisticated level, hypertext is a software environment for collaborative work, communication, and knowledge acquisition. Hypertext products mimic



the brain's ability to store and retrieve information by referential links for quick and intuitive access.

Current hypertext programs don't use typical database record and file structures; their databases usually consist of screen-size workspaces called nodes. You can fill these computer index cards with text, graphics, images, and audio and video data. Most hypertext implementations link nodes in either a hierarchical or nonhierarchical fashion; some support both structures.

Early designers envisioned hypertext either as an environment for interconnected writing and literature storage or as a sophisticated, multipurpose research environment that encouraged cooperative thinking on shared projects. Product development now proceeds on several fronts. Universities, including Brown, Carnegie-Mellon, and the University of North Carolina at Chapel Hill, are experimenting with hypertext systems as multiuser teaching, library-reference, and writing environments. Commercial hypertext applications-like on-line reference manuals and documentation, public information systems, authoring systems, coopera-

tive work systems, and personal organization tools-are either available or in development.

Hypertext programs, and the freeflowing databases that are their trademark, have been adapted for electronic publishing, project management, systems analysis, software development, and CAD. You can also find software

### The Pioneer Spirit

7 annevar Bush designed a simple machine by today's standards. It used microfilm and photocells to store its data. But Bush, who was President Roosevelt's science advisor, dreamed up an information organization and retrieval scheme bold enough to influence two hypertext pioneers 20 years after the fact.

The first researcher influenced by Bush's concepts of associative links and browsing was Douglas Engelbart. His research at the Stanford Research Institute in the early 1960s centered around using computers to augment human intellect. At that time, he began developing the On-Line System, or NLS, now called Augment and used internally for several projects at McDonnell-Douglas.

Augment is an on-line work environment. In its original form, it served as a storage receptacle for memos, research notes, and documentation; as a communication network, since on-line conferencing was possible; and as a shared work space where researchers could plan and design projects.

Still running on a DEC 20, Augment stores information in a sophisticated hierarchical structure allowing nonhierarchical branching. Since speed was important, Engelbart invented the mouse as an input device. He also came up with the concept of viewing filters. Via filters, you can view a shortened version of the statement or file, which lets you move quickly through a hypertext database, scanning for only pertinent data. In fact, Engelbart was the first to use an F10 context-dependent Help system, an integrated mail system, multiple windows, and a shared screen.

While these developments helped researchers deal with complex multidimensional problems, Ted Nelson took Bush's concept a step further. Nelson envisions hypertext as an on-line network holding the world's literary treasures under one roof. Xanadu is his version of the publishing utility of the future. It is, perhaps, the most wellknown hypertext system. It was Ted Nelson, in fact, who originally coined the word hypertext over 23 years ago to mean nonsequential writing.

As designed, Xanadu will be an everexpanding publishing environment that millions of people could use to create, interact, and interconnect with linked electronic documents and other forms of hypermedia, such as movies, audio, and graphics. It's designed to run in parallel on many networks of servers. On a basic level, a storage manager lets you create links between like topics and then keeps track of the origins, variations, and interconnections of the text.

Xanadu documents consist of native bytes, the original document and inclusions, information originally found in other documents, and hidden pointers. Links are attached to bytes. You can ask the system to tell you where bytes came from, and you can ask to see them in their original form.

Since the number of documents created via Xanadu's system can be immense, the system tracks documents using a four-part designator that can locate the server, user, document, and contents. (For a detailed explanation of the tracking scheme, see "Managing Immense Storage" in the January BYTE.) Xanadu is more than just an online reference system, however. It's also an interactive writing and conferencing environment.

One of the most radical points about Xanadu is that existing programs won't operate under it. New applications will need to be developed for it to gain widespread acceptance.

A Xanadu prototype is now up and running on a Unix-based Sun workstation. Nelson claims that products based on the Xanadu hypertext concept will ship sometime in 1989 (see the item in Microbytes in the July BYTE).

(e.g., outline processors, teleconferencing systems, and windowing products) that borrow some, but not all, hypertext techniques.

#### In Many Flavors

Hypertext systems come in many flavors and support varying tasks. Typical hypertext software consists of a text editor, graphics editor, database, and browsing

tool for three-dimensional viewing. (The browser is usually a graphic that you use to become oriented within a database filled with many nodes.) Bit-mapped displays, a mouse, windows, icons, and pull-down menus are all standard hypertext tools.

The various systems have one underlying database, and so far there's no DBMS standard. Current products use everything from home-grown to relational databases. Some products let you distribute the database across a number of networked file servers to create a collaborative hypertext environment.

When you use a hypertext application that you didn't help to author, you really see only the front-end of the programthe user interface. The machinations of the back-end, the database, are hidden. Depending on the application, some systems feature highly developed frontends, like those in CAI systems, or complex back-ends, like those in research and cooperative work environments.

As a system user, you have access to a number of indexing capabilities. You can create inverted files of words, phrases, or keywords in context and perform word or Boolean searches. Some programs let vou create hierarchical indexes, like tables of contents, while others let you create content-based indexes, like thesauri. Some systems let you create both.

If you write applications or use a system that doesn't delineate between author and user, you have access to hypertext's editing, linking, and development tools. You can author both simple and complex applications, depending on the hypertext system you use. In addition, many products let you invoke programs from your application at the touch of a mouse. These programs can be short and macro-like or large conventional programs that you would normally run from the operating system.

Not surprisingly, the only thing standard about hypertext systems is that there are no standards. It's a new technology with creative new implementations. One emerging standard, the Standard General Markup Language (SGML), lets hypertext authors create links across various applications. Although you usually hear SGML described as an electronic-publishing standard indicating type sizes and formats, it also features useful document-structure cross-referencing and indexing commands. Most text editors can read links created with SGML.

#### A Discrete Affair

To use a hypertext system, you must get used to parsing your information into small discrete units, or nodes, which consist of a single concept or idea. In theory, nodes are both semantically and syntactically discrete. The information contained in a node can usually be displayed on one computer screen. In situations where you need more space, some programs let you create longer nodes that scroll up from the bottom of the screen.

Nodes can come in two varieties:

typed and untyped. An untyped node is a box for information. It has no label or descriptor, so you can fill it with anything. A typed node is labeled, and the descriptor helps you determine the style of information contained in the node. Types help you to classify nodes or define specialized operations. They are also helpful when you're browsing through a database looking for a particular area of interest.

One system that uses typed nodes is gIBIS, the Graphical Issue-Based Information System from MCC (Microelectronics and Computer Technology Corp.). It's a prototype designed for systems analysis of complex problems. It lets you create three basic types of nodes: issue nodes, describing an issue you wish to discuss with your work group; position nodes, describing an assertion that resolves an issue; and argument nodes, containing your objection or support for a position node. Organizing nodes in this manner helps gIBIS users navigate easily through a complex hypertext network. (For more details, see the article "The Right Tool for the Job" on page 255.)

You can also combine nodes to form composite nodes. These are composed of related subnodes that can be handled as a single object or broken out into individual elements. You can create icons to reflect the contents of a composite node for easy access. You can also rearrange subnodes if needed.

Depending on the hypertext product you use, nodes can be displayed on the screen one at a time, as in Apple's HyperCard, or in groups, as in NoteCards from Xerox Palo Alto Research Center (PARC), a system designed for idea processing (see figure 1).

#### The Missing Link

In general, links are used to connect the nodes. A hypertext link is like an electronic footnote, an endnote, or a parenthetical phrase. That is, just as footnotes and parenthetical phrases direct readers of printed material to related points or further topics for research, hypertext links connect you to associated text or ancillary information.

Links, therefore, are the mode of transportation in a hypertext network. You follow them to move about between various nodes. You can usually embed them in text and then edit and review them to ensure that they are valid. You can also create, delete, or change link attributes.

Links must have two qualities: Your computer must be able to trace or follow them, and they must be able to transport you quickly from one node to another.

Usually one or two keystrokes or the tap of a mouse button is all you need to transport you from one node to the next. The total time required to traverse a link is small, usually only a second or less.

While it's normally up to you to create links between nodes, some products can create links automatically; this ability may be useful for systems that need to cross-reference large text databases. Systems such as NoteCards also let you "type" links. A typed link specifies a particular relationship between two nodes, one that you define.

Links can do more than just connect two nodes, however. Depending on the hypertext system, links can connect annotations to a document (including notes and comments, like electronic Post-its) and provide organizational information, such as where the text fits in a table of contents or where it originated. Therefore, links can help define the node's relationship to other nodes within the database. Links may also clarify the contents of charts and graphics by connecting the graphics to explanatory information like longer descriptions.

Links usually originate at a single point, like a sentence, called a link *reference*. Their destination, called a link *ref* 

erent, is usually a node, a chunk or region of text.

#### **Points and Buttons**

A point is a single character, token, or icon that "points out" a link in a document. It's usually identified by either the name of the destination node, the link, or an arbitrary string, and by whether it's a source or destination point.

HyperCard and Guide (from OWL International) refer to points as *buttons*. Buttons can trigger the display of additional information, traverse a link, or activate a program. They can be represented by text or icons, or, as in HyperCard's case, they can even be invisible. (For more information on these two popular microcomputer hypertext systems, see the text box "What about Micros?" on page 242.)

#### A Bird's-Eye View

Hypertext systems are designed to let you browse through or quickly peruse associated nodes. While this feature is important, it can also be a problem, because in large hypertext databases, you can forget how or why you got to where you are. To alleviate this problem of disorientation,

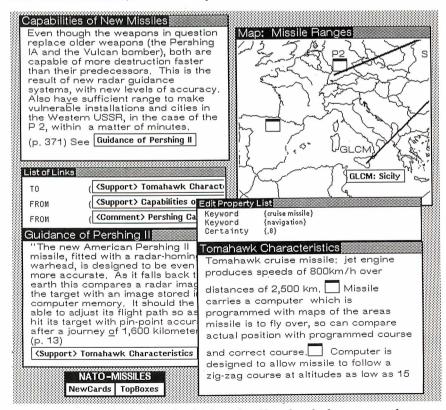


Figure 1: NoteCards' display of multiple nodes. Note that the lower two nodes further clarify the topic introduced in the upper left node. (Graphics courtesy of Frank Halasz from MCC.)

many systems provide a tool called a graphical browser.

The graphical browser is a node that contains a structural diagram of a network of nodes. Browsers usually supply a global or "zoom lens" map of the network. You can use the browser to orient yourself or to move directly to an area you're interested in by selecting that point on the screen with a mouse (see figure 2). While not all systems provide a graphical browser, most attempt to provide some type of overview system that helps you stay oriented in the network and visualize how information is linked. In large hypertext environments consisting of hundreds of nodes, browsing tools are especially important because it's so easy to get lost.

A browser can also help you decide on your next action. For example, Symbolics' Document Examiner, an on-line hypertext documentation system for Symbolics' Lisp machines, uses its browser, the Show Overview command, to help you quickly locate information. The command displays a tree-structured view of related nodes called *records*. By repeatedly using this command, you can get a feel for the context of the surrounding subject area and familiarize yourself with an area of interest.

#### A Variety of Tools

Depending on the particular product you use, commands and features may vary. Some hypertext products use a *path* to help you find your way through a network. Paths are default routes through a database; they guide or direct you through an ordered list of nodes.

When you follow a path, you are really letting the original author guide you to the next logical node, which relieves you of navigational duties. An example of a system that used paths is Textnet, created by Xerox PARC researcher Randall Trigg. It was designed as a multiuser literary-exchange system for the scientific community.

A viewing filter is another interesting hypertext tool. Basically, a filter does exactly what you'd think it would—it suppresses detail. By filtering the lower level of a node's contents, you can scan quickly through a network for the information you need.

#### Where the Products Are

The availability of windowing products and low-cost workstations with high-resolution graphics and storage options like CD-ROM have made the development of hypertext products more attractive. Fifteen or more systems are now used in universities and in research centers such as MCC and Xerox PARC, and commercial products are in development.

Hypertext systems vary significantly, depending on the applications and users they address. They are designed for either single-user or multiuser applications and are most commonly run on workstations, although more and more microcomputer applications are becoming available. HyperCard and Guide are perhaps the best known of the microcomputer products.

Typically, you'll find four types of hypertext systems: problem-resolution systems, on-line browsing systems, library or literary-exchange systems, and multipurpose systems. Depending on the type of system, the tools available may differ.

Systems designed primarily for problem resolution and network creation feature tools that help you define and analyze data through structured types of links and nodes. These systems help you organize elements in unstructured problems and feature commands that let you create and modify internal links between concepts quickly.

Most importantly, the tools can usually suppress details through viewing filters similar to those in Douglas Engelbart's On-Line System (NLS). (NLS is now used as a prototype for several collaborative-work projects at McDonnell-Douglas under the name Augment.) Such products might be used for systems analysis, idea processing, or authoring new applications. Augment and gIBIS are examples of systems designed to be problem-resolution work environments.

#### **Just Browsing**

Hypertext systems created primarily for browsing, such as CAI programs or online reference manuals, have fewer user tools for editing or link creation. These systems feature clear, understandable screen displays for presenting information and easy-to-operate browsing commands for perusing it. For example, the Document Examiner features a clean, book-like user interface and heuristic online string and keyword searches. You use these features to browse through the documentation, sometimes viewing information in several levels of detail.

Like many other browsing systems, the Document Examiner won't let you modify a reference manual, but you can keep a chronological record of recent searches or information of interest using the Bookmarks Pane. You can save personalized bookmarks and use a mouse to call bookmarks for fast retrieval. And

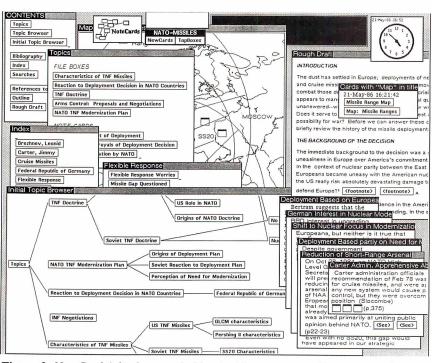


Figure 2: NoteCards' displays can hold a significant amount of information. In this screen shot, a graphical browser (lower left) takes up much of the display space; a contents node, a topics node, and an index node are also displayed; and pages of relevant information are shown at the lower right. (Graphics courtesy of Frank Halasz from MCC.)

# RUSH POSTAGE-PAID CARD FOR YOUR FREE CATALOG! Every NRI course features practical, pands on training with state of

Every NRI course features practical, hands-on training with state-ofthe-art equipment you keep.

Only NRI gives you the training and the equipment for career advancement, parttime earnings, or even a business of your own.

170-108

Name	(Please Print)	Age
Street		
City	State	Zip

Accredited by the National Home Study Council

### CHECK Please send my free catalog on NRI training in:

Computer Electronics
TV/Video/Audio Servicing
Robotics
Electronic Music Technology
Digital Electronics Servicing
Electronic Design Technology
Security Electronics
Communications Electronics
Basic Electronics
Bookkeeping and Accounting
Building Construction/Remodeling
Automotive Servicing
Small Engine Repair
Electrician
Air Conditioning/Heating/Refrigeration
Locksmithing
Travel Careers
Telephone Servicing
Paralegal

For career courses approved under G.I. Bill, □ check for details.



NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

### **BUSINESS REPLY MAIL**

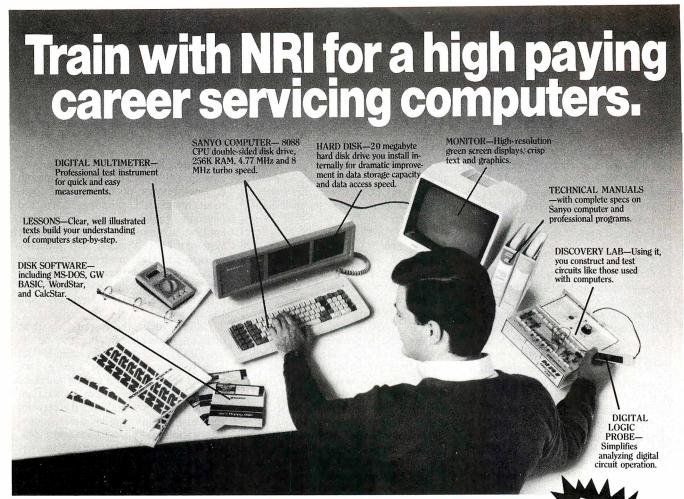
FIRST CLASS MAIL PERMIT NO. 10008 WASHINGTON, D.C.

POSTAGE WILL BE PAID BY ADDRESSEE



McGraw-Hill Continuing Education Center 3939 Wisconsin Avenue Washington, D.C. 20077-9265





Get started now by building this? fully PC-compatible computer

Now you get it all . . . training for one of America's fastest-growing career opportunities . . . training to service all computers...training on a total computer system. Only NRI can give you the wellrounded training you need, because only NRI gives you a complete computer system . . . computer, monitor, floppy disk drive, hard disk drive, software, even test instruments like a DMM and logic probe to work with and keep. It all adds up to training that builds the knowledge and ability you need to succeed as a computer service specialist.

#### Get inside the newest Sanyo Computer -fully compatible with the IBM PC\*

As an NRI student, you'll get total hands-on training as you actually build your own latest model Sanyo 880 Series computer from the keyboard up. It's fully compatible with the IBM PC and, best of all, it runs programs almost twice as fast as the PC. As you assemble the Sanyo 880, you'll perform demonstrations and experiments that will give

you a total mastery of computer operation and servicing techniques. You'll do programming in BASIC language—even run and interpret essential diagnostic software.

#### Understanding you get only through experience

You need no previous knowledge to succeed with NRI. You start with the basics, rapidly building on the fundamentals of electronics with bite-size lessons. You perform hands-on experiments with your NRI Discovery Lab and then move on to master advanced concepts like digital logic, microprocessors, and computer memories.

#### Learn at home in your spare time

You train in your own home at your own convenience, backed at all times by your own NRI instructor and the entire NRI staff of educators and student service support people. They're always ready to give you guidance, follow your progress, and help you over

the rough spots to keep you moving toward your goal.

#### Free 100-page catalog tells more... send today

Send the postage-paid reply card today for NRI's 100-page catalog that gives all the facts about computer training plus career training in robotics, data com-

munications, TV/audio/ video servicing, and many other fields. If the card is missing, write to NRI at the address below.

\*IBM is a registered trademark of International Business Machines Corp.



3939 Wisconsin Avenue Washington, DC 20016

We'll give you tomorrow

### What about Micros?

W ant to test the hypertext waters and see what all the hoopla is about? Well, if you don't have a workstation handy, two of your primary options for microcomputer hypertext environments are OWL International's Guide and Apple's HyperCard.

#### Guide

Guide, which runs on both the Macintosh systems and the IBM PC AT and compatibles running Microsoft Windows, is a general-purpose hypertext tool (see "Guide" by William Hershey in the October 1987 BYTE). A few of the applications you can develop with it include on-line documentation, storyboards, E-mail, and CAI courseware.

Guide lets you create dynamic layered documents. The "guideline" network is organized in both a hierarchical and a nonhierarchical manner. To move about hierarchically, you use replacement buttons, which follow embedded menus. You can also use note buttons to bring up complementary information, such as a definition of a word or phrase. An inquiry button, which reveals the other buttons at your disposal, is also available.

To follow nonhierarchical links, you use the reference button, which will jump you to a new document or a different section of the document you're in.

Guide 2.0 uses an internal script language to let you execute external programs from your Guide document. You can also access and control videodisk players and modems via the serial port. Last, but not least, a version called CD-Guide lets you create CD-ROM applications. OWL also markets a developer's toolkit so software developers can use Guide as a frame for an on-line help system.

**HyperCard** 

HyperCard, available for the Mac II, the Mac Plus, and the Mac SE, is a personal organization tool and a simple database manager (see "HyperCard" by Gregg Williams in the December 1987 BYTE). It is also a commercial software developer's tool and is in use in some corporations as a front-end to the mainframe database.

This system uses screen-size cards (or window-size cards on the Mac II) organized into topic-related stacks to create simple databases. One card is displayed at a time. Touching your mouse cursor to a button on a card executes a script written in HyperTalk, HyperCard's programming language.

You can browse through alreadycreated stacks (stackware), paint and type, author new cards and stacks, and write and edit HyperTalk scripts. (It's fairly easy to write scripts with Hyper-Talk because of its English-like syntax.)

HyperCard applications have been developed in many areas. Much stackware is available in the public domain.

Editor's note: An assortment of public domain stacks can be found on BIX in the "stackware" area of the listings conference. See page 3 for more details.

you can display a piece of documentation in an editor window while you write program code in another part of the screen.

The Document Examiner is particularly interesting because it's integrated into the software-development environment that it supports. It lets you scroll through the entire Symbolics software-development product documentation. The hypertext implementation of this documentation has an estimated 11,000 nodes and 23,000 links.

Another system designed for structured browsing by a large user base is ZOG, developed in 1972 at Carnegie-Mellon University and installed in 1982 as a computer-assisted information-management system on the USS Carl Vinson, a nuclear-powered aircraft carrier. Its applications included an on-line policy

manual and an on-line maintenance manual with a videodisk attachment.

The commercial version of ZOG is KMS (Knowledge Management System) from Knowledge Systems. ZOG/KMS uses frames instead of nodes; frames are connected by two kinds of links, hierarchical and cross-referential. To help you navigate through a network, frames are formatted with a name, a title, a body, tree items linked to lower-level links, and special and command items. For simplicity and speed, ZOG and KMS use neither overlapping windows nor a graphical browser. The developers focused, instead, on fast text-search capabilities, multiuser support, and a minimal system-response time.

CD-ROM is particularly well suited as a database for hypertext browsing sys-

tems. One such system, being beta tested by Boeing for Knowledgeset Corp., is an on-line maintenance manual for the Boeing 757.

#### **On-Line Libraries**

Systems envisioned to support mammoth on-line libraries, documents, and document creation and critiquing, such as Ted Nelson's Xanadu, are the third major application group of current hypertext systems. These systems will probably feature complex, multiple structured back-ends, or databases, that can store everything from collaborative notes and research to E-mail, documents, and whole libraries.

Unfortunately, these systems will be difficult to implement because of the complexity and size of the task. Before such systems can become a reality, we must develop a standard user interface and a central storage system. In addition, we must be able to maintain the network such that all links are legitimate, copyrights and royalty issues are addressed, and the systems are fast enough to meet the needs of the general public.

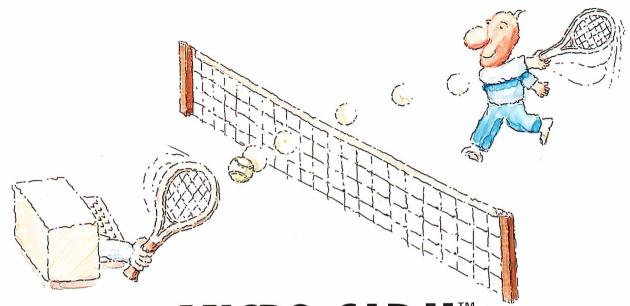
Significant research in this area has been completed. Ted Nelson and his colleagues have worked on Xanadu for years. Randall Trigg's system, Textnet, let users store archival documents, making time-consuming research unnecessary. The system allowed collaborative writing and the critiquing of new documents. It featured two types of nodes—those containing text and those containing tables of contents of other nodes. The system defines over 80 types of links.

While many of the designs for the original on-line library systems had to be implemented from scratch, researchers at Bellcore are working on a hypertext-like front-end to connect existing on-line encyclopedias, libraries, and wire services. When completed, Telesophy, as the design is called, will let you access CD-ROM, recorded speech, and image archives. (Putting existing text onto a hypertext system is a challenge in itself. See the article "From Text to Hypertext" on page 247.)

Several well-known hypertext products function as general-purpose systems. You can customize these products to fit your application or simply to experiment with hypertext itself. Note-Cards, HyperCard, and Guide are three such systems.

#### In the Driver's Seat

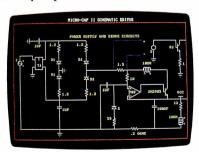
Regardless of the application, to use a hypertext system correctly, you must real-



# MICRO-CAP II.™ The CAE tool with fully interactive analog simulation for your PC.

Spectrum Software's MICRO-CAP II® is fast, powerful, and feature rich. This fully interactive, advanced electronic circuit analysis program helps engineers speed through analog problems right at their own PCs.

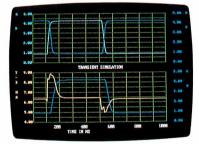
MICRO-CAP II, which is based on our original MICRO-CAP software, is a field-proven, second-generation program. But it's dramatically improved.



Schematic Editor

MICRO-CAP II has faster analysis routines. Better resolution and color. Larger libraries. All add up to a powerful, cost-effective CAE tool for your PC.

The program has a sophisticated integrated schematic editor with a pan capability. Just sketch and analyze. You can step



Transient Analysis

component values, and run worst-case scenarios—all interactively. And a 500-type\* library of standard parts is at your fingertips for added flexiblity.

MICRO-CAP II is available for IBM® PCs and Macintosh.™ The IBM version is CGA, EGA, and Hercules® compatible and costs only \$895 complete. An evaluation version is available for \$100. Call or write today for our free brochure and demo disk. We'd like to tell you more about analog solutions in the fast lane.

- Integrated schematic editor
- Fast analysis routines
- High-resolution graphic output
- Standard parts library of 500\* types \*IBM versions only.

- Transient, AC, DC, and FFT routines
- Op-amp and switch models
- Spec-sheet-to model converter\*
- Printer and plotter\* hard copy



AC Analysis



1021 S. Wolfe Road, Dept. E Sunnyvale, CA 94087 (408) 738-4387

MICRO-CAP II is a registered trademark of Spectrum Software

Macintosh is a trademark of McIntosh Laboratory, Inc. and is being used with express permission of its owner.

Hercules is a registered trademark of Hercules Computer Technology IBM is a registered trademark

of International Business Machines, Inc.



Time and again, you've heard it said, "To make money, you have to have money."

The truth is, you have to know how to save money before you can think about making more.

That's why more and more people are joining the Payroll Savings Plan to buy U.S. Savings Bonds. That way, a little is taken out of each paycheck automatically.

In no time, you'll have enough Bonds for a new car, your child's education, even a dream vacation.

Whatever you save for, Bonds are the safest, surest way to gain capital.



When you put part of your savings into U.S. Savings Bonds you're helping to build a brighter future for your country and for yourself. hypertext systems
give you control when
you may need
guidance.

ize that you are in the driver's seat. Hypertext products won't think for you. They have no artificial intelligence. They might help you clarify and manage your thoughts or speed you through your research, but you are in control. Your value judgments determine what to include in the database, what type of links to create, and how to organize topics.

If you use an on-line hypertext documentation system, you decide which nodes to access and which links to follow. If you follow obscure paths, you may find it hard to locate information. Likewise, if your associative powers are weak and you create meaningless links, you may well end up with a worthless database. To put it simply, branching documents, like hypertext, require greater attention from both the system's users and its authors.

#### The Problem with Hypertext

Hypertext is an immature technology with many problems yet to resolve. Perhaps the most difficult part of creating a hypertext system is not building the user interface but creating sound underlying data models that can be maintained.

Since hypertext systems need to be maintained, systems designers should watch for uncontrolled linkages, which will become maintenance problems. Just as large software programs with many patches can turn into "spaghetti" code, so a hypertext system can turn into a morass of meaningless, obscure connections and references. Hypertext systems, therefore, must let you edit and delete links and nodes easily.

Another problem for some users is that some hypertext systems give you control when, in fact, you may need guidance. You may, for example, get lost following obscure links before you have a firm grip on the basics of the subject area you're trying to research.

When you're reading printed text, a good author will guide you through a network of interrelated, relevant points. With hypertext, you guide yourself and make your own associations—at the risk of taking the wrong turn and getting lost.

Even experienced hypertext users can get lost in large hypertext networks. While graphical browsers may help, the lack of visual and spacial cues can still be disorienting. One of the valuable attributes of printed copy is that it has such cues.

Another issue is the difficulty of breaking a thought or a segment of information into a node. Themes in a document or thought can be very tightly interwoven, so much so that breaking the information into discrete nodes would be detrimental. Therefore, not all literature is suited for a hypertext literary system.

On a similar note, even though information may have discrete components, you may not be at the level where you perceive these units when you are constructing a hypertext application. In such cases, you might break information into nodes prematurely and at a later time realize that your logic was skewed. Then you would need to edit, rearrange, or retitle the information.

Unfortunately, such changes are not well-supported by all hypertext systems at this time. Virtual structures—nodes, links, or composites—would be useful in this situation. They would change dynamically when you add or delete nodes and links, depending on their descriptions. Virtual structures are similar to relational database views.

One last concern is that many hypertext systems are really only suited for new application development. Converting existing applications to hypertext is a difficult task because the file structures are so different.

#### **Tremendous Potential**

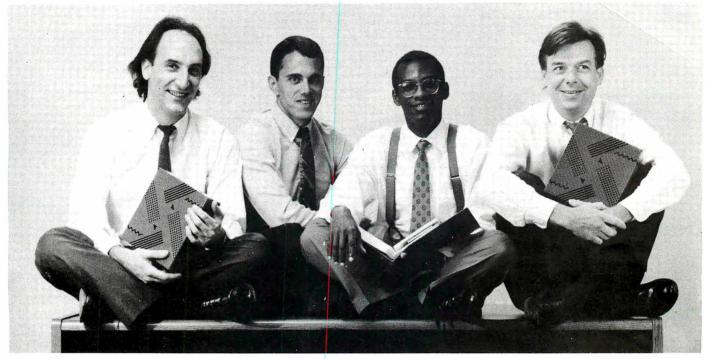
Augmenting human intellect with the help of hypertext is a grand vision indeed, one worth exploring. Hypertext applications, including interconnected writing, on-line libraries, and collaborative work environments, have tremendous potential. Current products are just the forerunners of more sophisticated applications, and we will probably see many hypertext features in mainstream software packages.

But hypertext is still in its infancy; implementation and design problems and standards issues must be resolved. Just as it takes a writer time to shape and mold a good short story, it takes time for the structure of new concepts to gel and for practical applications to emerge. But the concepts that underlie hypertext, whether they go by that name or another, will be with us for a long time to come.

Janet Fiderio is a BYTE technical editor. She can be reached on BIX as "jfiderio."



# MEET THE GUYS WHO CHEATED DIGITAL EQUIPMENT CORPORATION OUT OF \$60,000,000.



With their software, you can do everything a \$1000 DEC terminal does — on your PC — for a mere \$245.

The suave and debonair gentlemen bandits who sit before you virtually invented DEC terminal emulation for the IBM personal computer.

To the uninitiated, what that means is this.

With their software, you can do everything a \$1,000 DEC terminal can do — right on your own PC — for the paltry sum of only \$245.

Has business been good for our heroes?

You bet: to the tune of 60,000 users, who would otherwise have blithely gone out and bought DEC terminals.

Does this make DEC happy? What do you think.

#### Heavy DEC Experience + Heavy IBM Experience = Perfect Emulation.

The product these wizards invented is VTERM/220. And the reason it's so good, frankly, is that nobody has more experience than they do in DEC emulation on a PC.

With VTERM/220, you can emulate DEC's VT220, VT102, VT101, VT100, and VT52 terminals.

Of course, there's emulation and then there's EMULATION. This is TRUE EMULATION. Com-

plete! Comprehensive! Thorough! Fast! Accurate! Installation's a snap. Setup is a simple full-screen operation. You can toggle between DOS and the terminal screen and put mainframe data directly into PC spreadsheet and data base products such as Lotus 1-2-3<sup>†M</sup>, dBase<sup>™</sup>, and Multiplan<sup>™</sup>. And for file transfer, there's XMODEM, ASCII, Kermit or VTRANS, our own high-speed, error-correcting protocol.

#### One last word from the Robin Hoods of software.

Are there other terminal emulators?

Of course there are.

But, we invented DEC terminal emulation at Coefficient. We know the subtleties, the little features (and the big ones) that make an emulator a joy to use. And we've incorporated them all into VTERM/220.

Just ask any of our 60,000 users.

They paid us the highest compliment of all. They chose our software over the real thing.

A free working copy of their software. Free? Yes, free.
There's only one way to experience the speed, power, and simplicity of VTERM/220. Try it.  Send me a free, time-limited, full-blown working copy of VTERM/220, which is mine to keep.  Send me a free, time-limited full-blown working copy of your new \(\subseteq VTERM/4105\) or \(\subseteq VTERM/4208\) Tektronix graphics terminal emulators.
Name
Title
Company
Address

Telephone ( dealer. I am a user

Coefficient Systems Corporation
611 Broadway, New York, New York 10012
Voice: (212) 777-6707, ext. 421 Fax: (212) 228-3137 Telex: 6503156498 MCI Mailbox: CSC

PC is a registered trademark of IBM. DEC and VT are registered trademarks of Digital Equipment Corp



#### **NEW MINI PORTABLE** BEST-286 LCD

- ☐ 10 MHZ 0 WAIT (12 MHZ Option)
- ☐ 512 K RAM
- ☐ 1.2 M. Floppy Drive
- ☐ 20 MB Hard Disk
- ☐ 165 W DC Fan Power Supply
- ☐ Serial & Parallel
- ☐ Non-Glare LCD Screen
- □ Super Twist
- Built-In Back Light
- ☐ 640 x 200 Dots (640 x 400 Optional)
- ☐ Weight 22 lbs
- ☐ Padded Soft Carry Bag
- ☐ Dimension 16" x 8" x 9"

\$1650



#### BEST-286 DESK TOP

- ☐ 12 MHZ
- ☐ 512 K RAM (4MB RAM Expandable)
- 1.2 MB Floppy
- ☐ EGA Monitor
- ☐ EGA Card (Paradise Compatible)
- □ 20 MB H.D. (ST-125 28ms)
- Serial & Parallel Port П
- □ 8 I/O Slots
- □ 200 W W Power Supply
- ☐ Fujitsu 101 Enhanced Key Board

\$1675

BEST-88 DESK TOP \$ 605



#### **BEST-286 PORTABLE**

- ☐ 12 MHZ
- ☐ 512 K RAM
- ☐ One 1.2 MB Floppy Drive
- □ 7 Expension Slots
- 200 W DC Fan Power Supply
- □ 9"Amber Screen
- ☐ Mono or Color Graphic Card
- ☐ Serial & Parallel Port

BEST

☐ 84 Key Soft Tough Key Board

**\$**1155

BEST-88 PORTABLE \$845

#### 386 SYSTEM

- ☐ 16 MHZ 80386 CPU 8/16MHZ
- ☐ 20 MHZ (Option) □ 80287 & 80387 Socket
- 1 M RAM
- ☐ One 32-bit, Five 16-bit, Two 8-bit Expansion Slots
- 1.2 M Floppy Drive
- □ WA2 or NCL Control Card
- ☐ 3.5" Drive (Option)
- □ Tower Chassis

\$1995



#### 286 BABY MOTHER BOARD

- 12 MHZ 8088 Mother Board Mono Graphic Color Grephic 80286 I/O Card 200 W Power Supply 150 W Power Supply Mono Monitor
- EGA PLUS 640 x 480 (Paradise Compatible)
- PORTABLE CASE 9" Dual Amber Monito 200 W Power Supply 9"Dual Amber Monito 150 W Power Supply
- LCD CASE 640 x 200 Dots 640 x 400 Dots
- \$139

# **BEST-286 LAPTOP**

- □ 10 MHZ 0 Wait (12 MHZ Optional)
- ☐ 512 K RAM
- □ Two 1.44 M Floppy Drive
- ☐ Back Light Supertwist LCD
- □ 80 x 25, 640 x 400 Pixels Graphics □ 20 MB or 40 MB Hard Disk
- ☐ Enhance 86-Key Key Board
- ☐ One Parallel Two Serial Port ☐ Dimension 16" x 11" x 3.5"
- ☐ RGB / Monochrome Monitor Port
- □ AC Adaptor
- ☐ 1.5 Hours Rechargeable Battery (Optional)
- (Optional)
- ☐ Weight only 11 Lbs.

\$1950

DEALER CALL FOR DISCOUNT

BEST COMPUTER INC. 5017 Telegraph Road

Los Angeles, CA 90022

Tel: (213) 265-0900 Tech: (213) 265-0300

Fax: (213) 265-4234 Toll:

(800) 634-7920 Outside Cal.



MON - SAT 9:00 - 6:00 PACIFIC TIME PRICE ARE SUBJECT TO CHANGE WITHOUT NOTICE (DEALERS: 33)

Circle 32 on Reader Service Card

Credit Card Purchase Subject to Service Charge

# From Text to Hypertext

Traditional tools like outline processors already incorporate many of hypertext's lessons

Mark Frisse

ne reason hypertext is attracting so much attention these days is that more and more people are communicating via electronic media. Equipped with a modem and a microcomputer, you can spend a good bit of time reading electronic bulletin boards, composing electronic mail messages, contributing to group databases, and preparing large documents for printing and distribution.

However, communicating through these channels means that you often have to integrate fragments of text into your personal computer archives. You can do this by placing text items as separate entries into a file system, which works as long as you don't have too many interdependent files to manage. Hy-

pertext programs provide another alternative for information storage.

But hypertext can be used for more than creating simple databases of 3 by 5 cards. You can also use these programs to convert on-line versions of a printed document, such as a book, into hierarchical hypertext skeletons amenable to complex user-specified interactions. The examples included in this article come

Robert

from converting part of a manuscript for a medical textbook into an experimental hypertext handbook using Xerox's Note-Cards. You can follow them to learn some of the tips you'll need to turn text into hypertext.

#### **Setting Up the Cards**

Hypertext lets you rearrange text. In the early systems described by Theodor Nel-

son and Douglas Engelbart, the basic unit of text is a single character. New documents are created by linking characters from different documents. For instance, character strings from Romeo and Juliet could be merged with those from Julius Caesar to create a new play entitled Caesar and Juliet.

While this approach is exciting, it isn't widely adopted in hypertext design. A second approach, which is advocated by developers of systems such as Xerox's NoteCards and Apple's HyperCard, specifies a nondecomposable data structure, often called a card. You define cards both in terms of the types of data structures they support (e.g., text, bit-mapped graphics, and video) and the operations that can be performed on the data structures (e.g., text in-

sertion and deletion).

To map a flat-text file onto a set of hypertext cards, you first decide how much text you want to place in each card and then create a program that will perform this transfer with minimal intervention. If your text file consists of a series of Email items, addresses, or telephone conversation summaries, you can easily fit

each item from the text file into a separate card. If an essay or other lengthy text file is not divided into logical sections, you usually must place an arbitrary number of paragraphs onto a card. You can write sentences into scrolling text fields, but this approach can detract from the power of the card metaphor.

But the organization of some flat-text files can't be characterized as either a series of discrete, unrelated paragraphs or a single lengthy text file. The medicalhandbook text files used in these examples are hierarchically structured documents. A specific set of identifierseither Roman numerals, uppercase letters, integers, or lowercase letters-pinpoints each level of the hierarchy (see figure 1). Because the text between the identifiers consists of only a few sen-

- II. Pathophysiologic mechanisms. Respiratory failure can be separated into oxygenation failure and ventilation failure. While the two may occur together, it is useful to separate them to understand their pathophysiology and management. In addition, critical tissue hypoxia may result from nonpulmonary factors that influence oxygen delivery, and these must also be considered in comprehen-
  - A. Oxygenation failure. The transfer of oxygen from alveolar air to pulmonary capillary blood is affected by the partial pressure of oxygen in the alveolus (PAO2), the diffusion of oxygen across the alveolar-capillary membrane, and the matching of alveolar ventilation to capillary perfusion. The five mechanisms that may lead to a low arterial oxygen tension (PaO2) are low inspired oxygen tension, alveolar hypoventilation, diffusion impairment, mismatch of ventilation to perfusion, and right-to-left shunt. The goal of oxygen therapy is to relieve critical hypoxemia. Although clinical criteria are important, serial ABGs are crucial to plan and evaluate treatment.
    - 1. Response to oxygen administration depends on the underlying pathophysiology (see sec. II.A). Three patterns are common.
      - a. Hypoxemia caused by mild to moderate lung disorders. This pattern is typical of flu and asthma.
      - b. Hypoxemia caused by severe lung disorders is more refractory to supplemental oxygen, and potentially toxic concentrations are often typical of severe disorders.

**Figure 1:** A representative section of a medical handbook. The identifiers are (in order) Roman numerals, uppercase letters, integers, and lowercase letters.

### S1.II. PHYSIOLOGIC MECHANISMS II. Physiologic mechanisms. Respiratory failure can be separated into oxygenation failure and ventilation failure. While the two may occur together, it is useful to separate them to understand their pathophysiology and management. In addition, critical tissue hypoxia may result from nonpulmonary factors that influence oxygen delivery, and these must also be considered in comprehensive treatment. S1.II.A. OXYGENATION FAILURE. THE TRANSFER OF OXYGEN S1.II.B. VENTILATION FAILURE IS PRESENT WHEN THE S1.II.C. OXYGEN DELIVERY AND TISSUE OXYGENATION S1.II.D. INSPIRATORY MUSCLE FATIGUE OCCURS WHEN THE

Figure 2: A hypertext card from the same section of the medical handbook. The card contains only the text delimited by the identifier II and the identifier A. The titles of other child cards denoted by uppercase B, C, and D are visible on the hypertext card but not on the page displayed in figure 1.

tences or paragraphs each, it's appropriate to use these identifiers as card delimiters (see figure 2). In text files with many sentences between delimiters, you might have to obtain a line or paragraph count to decide when to start a new card.

#### Making the Connections

Hypertext's power resides in the links that weave isolated cards into a unique graph-structured fabric. When you transform a flat-text file into hypertext, you must recognize two distinct classes of links. The first, structural links, enforces the mapping between the conventional document and the hypertext skeleton. These links must be generated by programs, text parsers, that convert conventional text into hypertext. The second class, user-defined links, lets you create new, nonsequential paths through text.

Each collection of cards in a hypertext document has some underlying order maintained by structural links (see figure 3). The order of cards in a randomfile hypertext database (e.g., recipes, phone numbers, and so on) can be arbitrary and quickly modified through standard sorting techniques. The order of cards representing a lengthy essay is sequential and usually static. E-mail stacks can be ordered by topic, and, within a topic, by date of receipt. In a hierarchically structured document like the medical handbook, card order resembles a tree. In this case, the limbs of the tree declare the structural relationships between cards.

A text-parsing program converts flattext files into hypertext documents. The underlying structure of the flat-text file determines the text parser's complexity and function.

For example, database parsers can look for new record identifiers. These identifiers signal the system to create a new card and to copy the new record's contents to the new card. Parsers for essays can simply allocate to each card in turn as many paragraphs of text as will conveniently fit on each card. Parsers for mail systems, on the other hand, might require a list of acceptable identifiers and, for each topic, a pointer to the last card filed under the identifier. Parsers for hierarchical documents can use an ordered list of identifiers to create a hierarchical hypertext consisting only of cards and structural links.

For each possible set of identifiers, there exists only a limited number of "acceptable" tokens that lead to creation of a new card and appropriate links. For example, if you were placing text from a section labeled "V.C.2.a." into a card,

the acceptable identifiers would be any member of the set VI, D, 3, b (see figure 4). If the identifier read was D, the current subtree "C.2.a." would be popped, a new card of level "VI.D." would be instantiated, and a structural link between card "VI." and card "VI.D." would be created. Defining card identifiers appropriately is critical for simple, rapid parsing of hierarchical documents.

Although most flat-text file parsers employ ad hoc grammars, the parsing process will be simplified if document-definition language standards become more widespread. One of these, the Standard Generalized Markup Language (SGML), appears particularly promising. SGML emphasizes document structure over document appearance. For example, the standard might identify a string as a "section heading," but it would not make any statements about the section heading's font or size.

SGML also lets individuals or groups define logical structures for new document types. This flexibility increases the likelihood for standards in specialized and highly technical publishing niches. Finally, the interest shown in SGML by the federal government has encouraged the development of a number of tools for authoring, revision, and document parsing. Conceivably, these tools can be used to simplify the conversion of text already in electronic form into personal or community hypertext.

#### Finding the Right Card

Creating a hypertext from a flat-text file is rather simple. You exploit document identifiers to parse the file and create the new data structure. Developing the software that lets you access appropriate portions of a hypertext document is much more difficult. Most hypertexts let you access cards through several methods.

First, the initial cards in many hypertext documents contain a brief table of contents. This method provides you with an overview of the overall organization of the hypertext document. Browsers are another way you can find a card. They are useful when you want to peruse small lists or card networks. String patternmatching is the third card-access method. It's useful when you think that the search will retrieve a small number of useful cards and very few, if any, useless cards.

Unfortunately, there are many situations where these methods are inadequate. The table of contents method fails when a card can be filed under any one of several categories, which requires you to continued

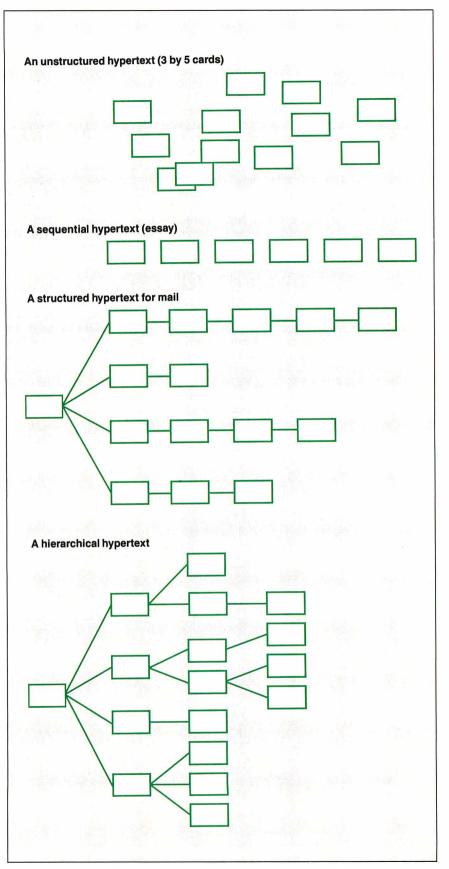


Figure 3: Hypertext file-card arrangements. Some applications, like unsorted recipes or telephone logs, require only a random ordering. Long essays generally require a sequential ordering. Mail files resemble trees with a strong sequential component. Complex documents in outline format require hierarchical data structures.

search many categories to find desired information. Browsing can be laborious if there are many cards to peruse, and pattern matching fails if the desired card uses a synonym (poor recall) or if there are many unwanted cards containing the same search string (poor precision). Therefore, you need alternative methods for both card indexing and card retrieval.

#### **Hypertext Indexing**

You can, however, exploit two powerful document-indexing techniques in hypertext. The first, indexing using a controlled vocabulary, classifies each document by one or more members of a finite set of descriptor terms. The National Library of Medicine's Medical Subject Headings (MeSH) system is one of the best examples of this approach.

This 15,000-term hierarchical vocabulary is used to classify most of the world's medical literature. Its principal advantage is that it is a widely agreed-upon vocabulary implemented by experts in the field of medical classification. This ensures that properly trained

users, and effective programs, retrieve equivalent queries.

Unfortunately, there are two major shortcomings to indexing small hypertext documents with controlled-vocabulary terms that are developed for larger documents. First, you must create the vocabulary so that each card is classified by at least one term, and you must have a relatively uniform distribution of classification terms among all hypertext cards. Both criteria are difficult to achieve. Second, the contents of the cards using the index terms must be classified manually, a prohibitive expense for most hypertext authors.

You can use a second powerful document-indexing technique, classification with an uncontrolled vocabulary, when a structured body of index terms is not available or when cost factors prohibit the controlled-vocabulary method. The uncontrolled-vocabulary method creates inverted indexes by eliminating stop words (e.g., the, are, a), removing suffixes (e.g., -s, -ing, -ed), and retaining word roots as indexes into the text file.

Figure 4: The characters preceding each section of the handbook serve both as delimiters to assigning text to a card and as identifiers to control the parsing and creation of links between cards. The leftmost tree is a part of the subtree present when the active card is V.C.2.a. The arrows depict each possible new card identifier. The rightmost trees depict the trees that would result from the detection of each legal identifier.

For example, the sentence "The lungs are inflated" creates the index terms "lung" and "inflate." In general, the index file will be about one half the size of the text file. Proponents of this approach argue that, for most domains, it is as effective to retrieve information this way as it is via controlled vocabularies. Moreover, the software needed to create these indexes is readily available. But for many applications, the space required by the indexes and the problems that occur because of misspellings and synonyms offset the benefits of indexing with an uncontrolled vocabulary.

#### Making the Best Match

Adding information-retrieval approaches commonly used for larger documents could make hypertext systems more powerful and responsive. How you implement these approaches depends on the structure of the underlying hypertext. In unstructured, highly modular hypertext (e.g., unrelated cards with significant amounts of free text on each card), the hypertext is really just a "folder" containing many tiny documents. In these settings, you don't need to enhance traditional free-text document-retrieval techniques. If, on the other hand, you have created a highly structured hypertext, you must exploit retrieval techniques.

In the hypertext medical handbook prototype, the power of uncontrolled-vocabulary indexing techniques that measure card content was combined with heuristic card-weight propagation functions that reflect card context. This was done so that the user could identify the "best" set of cards for browsing about a requested topic. The system doesn't try to identify a card with "the answer" to the query.

For example, if a hierarchically structured hypertext contains several potentially useful sibling cards whose parent doesn't contain text relevant to the query, you could design the system so it presents you with a sequential list of the sibling cards (see figure 5). As an alternative, it could just show you the parent card and provide a note on the card saying several of the children appear to contain useful information (see figure 6).

The good point about the second option—seeing the parent card—is that it conveys additional information concerning the context in which the various child cards are stored. This means you can better judge their relevance.

There are three basic steps to implementing this approach. First, define a utility function that calculates a card's intrinsic "utility" based on the query

#### TEXT TO HYPERTEXT

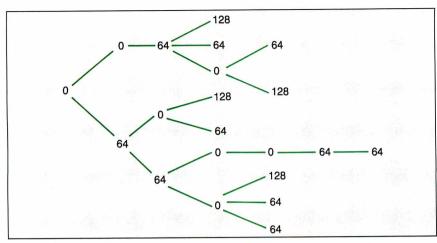


Figure 5: This graph displays only the intrinsic card utilities resulting from a query. Cards with positive values contain one or more terms in common with the query terms. Cards with a value of 0 do not contain any of the query terms. The graph displays only structural links between cards.

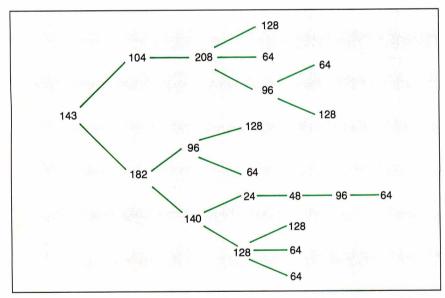


Figure 6: Here, a graph displays the total card weights, which are the sum of the intrinsic card utilities based on card content and the propagated weights based on card context. Even in this simulation, the propagation of weights has a marked impact on the ranking of cards and suggests that the lower subtree might prove to be a good candidate for browsing.

terms and card contents. Then, identify a method that propagates these weights to neighboring cards so that cards with contextual information are recognized. Finally, use both the intrinsic utility and the propagated weights to identify which cards should be considered candidates for graphical browsing. Let's analyze each of these steps in greater detail.

#### Weights and Measures

A card's utility is due in part to the correspondence between terms within the card and the query terms stipulated by the user. This component of card utility is called the intrinsic weight, and the value can be calculated using a modification of Salton's well-known algorithm.

This algorithm assigns term weights to cards as a function both of the frequency of occurrence of the term in the entire search space and of the number of cards containing the term. The algorithm assigns a higher weight to cards containing infrequently used terms and also to cards containing several occurrences of a term that is not found in many other

#### The best

## **Modula-2**

#### compilers for PCs and compatibles

#### Tavlor Modula-2

The professional high-performance compiler for PCs: the fastest compiler in the world!

\* unrivalled speed of compilation

7.000-10.000 lines per minute (80286, 8 MHz).

excellent code

Mini-computer standard global optimisation. Code performs 1580 Dhrystone tests per second! (80286,8 MHz)

\* ultra-compact

high code density and a library of unrivalled compactness

(23 modules in a total of 13K!)

\* completely standard implementation Follows N. Wirth's standard for Modula-2. BIOS independent - uses MS/PC DOS exclusively.

\* easy to use

Straightforward user interface. Comprehensive documentation for system programmers.

\* Guarantee and support One year guarantee. Maintenance contracts available. Swiss quality product.

TaylorModula-2 Demo disk

\$ 900 \$ 10

#### M2SDS

\$ 99

The professional Modula-2 software development system M2SDS comprises the following features in an easy-to-use window environment:

- modern, syntax-driven editor
- fast compiler
- linker producing EXE programs
- unique library manager
- comprehensive standard library

There are a vast number of tools, toolboxes, demo disks, public domain programs and books for M2SDS - probably more than for any other development system! M2SDS was used for the writing of the Farsight integrated business software pack-

Demo disks

\$ 10

#### JPI-Modula-2

\$ 149

A reasonably-priced Modula-2 compiler with a configurable environment, integrated Make function and highly optimising code generator.

We have Modula-2 compilers for the Amiga, HP9000/300. IBM/370, OS-9 and Sun. The list is constantly growing!

Texas residents add 8% sales tax. International Orders add

The Modula-2 people:

# INTERFACE

3336 Richmond, Suite 323 Houston, TX 77098-9990 (713) 523 8422

**Dealer inquiries welcome** 

International Austria: 0222/4545010 Belgium: 071/366133 France: 20822662 Italy: 02/405174 Scandinavia: +45/3/512014

Switzerland: 01/9455432

United Kingdom: 01/6567333 Germany: 02983/8337; 0731/26932; 0821/85737;



Im Späten 23 CH-8906 Bonstetten/ZH Switzerland Tel. (41)(1) 700 30 37

04106/3998

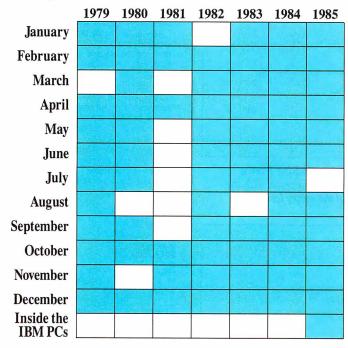
0531/347121

# **WAREHOUSE SALE**

Order These Back Issues of BYTE and Popular Computing Before They're Gone Forever!



Limited Quantities — Order Now!



\$4.00 U.S. includes shipping and handling \$5.00 foreign includes shipping and handling

Available Issues	

#### **Popular Computing**

Limited Quantities — Order Now!

	1982	1983	1984	1985
January				
February				
March				
April				
May				
June				
July				
August				
September				
October				
November				
December				
pecial Guide o Computers			- 15 - 15 - 15 - 15 - 15 - 15 - 15 - 15	

\$3.00 U.S. includes shipping and handling \$4.00 foreign includes shipping and handling

#### **Special Bound Copies of BYTE**

Volume I, Part 1— September 1975 through April 1976

Volume I, Part 2— May 1976 through

December 1976

Volume II, Part 1— January 1977 through

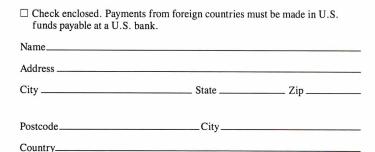
June 1977

Volume III, Part 1— January 1978 through

June 1978

Volume III, Part 2— July 1978 through December 1978

\$9.95 U.S. includes shipping and handling \$11.95 foreign includes shipping and handling



Please indicate which issues you would like by checking  $(\sqrt{})$  the boxes.

Send requests with payments to:

BYTE Back Issues One Phoenix Mill Lane Peterborough, NH 03458 (603) 924-9281

Charge:	$\square$ VISA	☐ MasterCard		
Card #				
- Cura # _				
Evn Dat	e			
Exp. Date				
Signature				
Signature				



cards. The formula is as follows:

$$weight_{ij} = k \times freq_{ij} \times (\log(n) - \log(docfreq_j) + 1)$$

where  $weight_{ij}$  is the weight component of card i due to term j; k is a constant; freq<sub>ii</sub> is the number of occurrences of term j in card i; n is the number of cards in the collection; and docfreq, is the number of cards containing the term j.

A card's utility also depends on its relationship to other cards. The term extrinsic weight describes the component of a card's total weight contributed by propagation from neighboring cards. In the hypertext medical handbook, a card's extrinsic-weight component depends on the weights of its immediate descendant cards. The following formula represents this dependency:

$$\begin{aligned} \textit{totalweight}_i &= \sum_{j} \ \textit{weight}_{ij} \\ &+ \frac{1}{y} \ \sum_{d} \ \textit{totalweight}_{d} \end{aligned}$$

where y is the number of immediate descendants of card i, and d is an immediate descendant of card i.

This propagation function is called recursively from the leaf cards to the root card. A graphical display of the search subtree and card weights (see figure 6) serves as a road map for browsing.

Term-weight assignment and propagation allow for cards to be ranked on the basis of an estimate of their utility to the user. In general, you hope for a ranking that will produce a short list of cards that are distributed throughout the hypertext. In this situation, you can quickly explore various subtrees, jumping from one location to another. You can, however, retrieve more aberrant lists. Consider, for example, the common case where the second-highest-ranking card is the parent of the highest-ranking card.

Presenting both cards on the browsing candidate list may suggest that the cards represent two markedly different avenues for browsing rather than the actual state of term-weight predominance in a single subtree. As an alternative, you could remove the highest-ranking child card and display only the parent, under the assumption that the increased context provided by the latter outweighs the decrease in weight due to card content. However, if this process is applied recursively, you ultimately will arrive at a card list containing only the root of the tree. You can apply several heuristics to manage these aberrant cases. One of the most useful heuristics halts the replacement process when the replacing parent card is of some fractional weight of the original highest-ranking card.

In addition to the obvious traditional problems associated with uncontrolled indexing vocabularies and full-text document retrieval, the approach used throughout this article is limited in many other ways. First, the propagation function does not take into account graphs, cycles, and link types with different semantics. Second, the current approach can't exploit user feedback in any meaningful way.

It would be desirable to update card weights dynamically on the basis of user responses to the card's contents. Unfortunately, most alternative approaches to this problem (e.g., Bayesian updating or Connectionism) appear too impractical for routine use.

#### **Learning Its Lessons**

Many points about creating and using hypertext are already clear. First, you have to distinguish hypertext programs from hypertext documents. You can use hypertext programs for tasks ranging from replicating mundane 3-by-5 card files to creating complex hypertext documents consisting of multiple interrelated cards and links. This distinction is crucial, since only card content is important for simple 3-by-5 card files, but both content and context are important when creating true hypertext.

Second, it's easy to build hypertexts and add links incrementally, but it's difficult to use hypertext effectively. Even with extensive search capabilities and graphical browsers, it's not always possible to retrieve desired information or to avoid getting lost in a hypertext graph.

Third, the computational complexity of information-retrieval algorithms suggests that alternative computer architectures might be more useful.

Finally, it's clear that many problems in the field are unresolved. Will effective updating and revisions require that links be bidirectional? Can we arrive at a standardized set of hypertext card types (e.g., text, graphics, sound, and video)? Will hypertext systems provide a true advantage over other media?

Traditional tools like outline processors have already incorporated many of hypertext's lessons. Similar innovations will affect E-mail, collaborative work tools, and others in the future.

Mark Frisse is an assistant professor of medicine and medical informatics at the Washington University School of Medicine in St. Louis, Missouri. He can be reached on BIX as "editors."

### **Tools and Toolboxes Modula-2**

### **Applications Generator**

Amadeus

Generate Modula-2 programs directly from your own input, and save yourself hours of coding!

#### Graphics

M2Graph\* Controls Hercules cards in Modula-2 \$ 65 \$ 65

M2EGA\*

Controls EGA cards in Modula-2.

Modula Graphics Toolbox I\* \$ 112 A collection of extremely fast graphics routines for CGA cards written in Modula-2.

Modula Graphics Toolbox II\* \$ 188 Comprehensive package of Modula-2 procedures for all currently available graphics cards. Includes grahics window system, fort generator, sprite handler, mouse driver, maths routines, as well as pie chart, histogram and line graph functions etc.

#### Input/Output

LCR-Window Manager\* Fast, compact window system.

\$ 133

tions etc.

M2Windows\* \$ 188
Fast, professional window system. Small, high-performance library with integrated menu system and simple mask gene-

Modula Mask & Menu Generator\* \$ 360
Development system for creating masks and menus in
Modula-2 source code. Mask, menu and frame editor. Supports all colours and attributes.

#### Other Tools

M2 Prolib \$ 495 The professional library **B-Tree ISAM** \$ 290 Ultra fast databas

\$ 59 Pascal-Modula Converter Converts Turbo-Pascal to Modula-2.

**RTA-Utility Disk** 2-10x faster I/O, extended MathLib.

\$30 \$ 188

**EMS-Utilities\*** Make full use of your Megabytes of memory expansion.

#### M2IEEE-Interface\*

\$ 144 Modula-2 interface to National Instruments IEEE Interface. This is only a small selection from our comprehensive list of tools for Modula-2. Demo disks are available for products marked with an asterisk. Send \$ 10 for three demo disks. \$ 20 for seven. There is also a wide choice of books and ite-

n Modula-2. da-2 compilers f

The Modula-2 people:

### INTERFACE TECHNOLOGIES

3336 Richmond, Suite 323 Houston, TX 77098-9990 (713) 523 8422

**Dealer inquiries welcome** 

International Austria: 0222/4545010 **Belgium:** 071/366133 France: 20822662

Italy: 02/405174 Scandinavia: +45/3/512014 Switzerland: 01/9455432

**United Kingdom:** 01/6567333 **Germany:** 02983/8337; 0731/26932 0821/85737; 04106/3998



A. + L. Meier-Vogt Im Späten 23 CH-8906 Bonstetten/ZH Tel. (41)(1) 700 30 37

0531/347121

# For Anyone Who Considers Code A Four Letter Word.

If you think writing program code is a dirty business, we have something to help you clean up your act.

It's called Matrix Layout. Layout lets you create programs that do exactly what you want, quickly and easily—without writing a single line of code. Layout does it for you automatically, in your choice of Turbo Pascal, Turbo C, Microsoft C, Quick-Basic or Lattice C. And if you're not a programmer, you can even create programs that are ready-to-run.

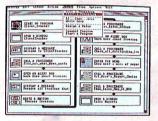
As the first true CASE (Computer Aided Software Engineering) development tool for the PC, Layout lets you write your programs simply by drawing an icon-based flow chart. They'll have windows, icons, menus, buttons, dialog boxes, and beautiful graphics and text. Like the Macintosh and the OS/2 Presentation Manager.

And because Layout is so efficient, everything you create will work incredibly fast, even on standard PC's with 256K and only one disk drive. To top it off, all your programs will feature Layout's automatic mouse support, sophisticated Hypertext functions, and decision handling.

The full Layout package also

comes with three additional programs:

Matrix Paint is a professional paint program that comes with a full palette of high-powered graphics tools, plus scanner support. And any picture or symbol that you draw or



Draw a flow-chart.
 Matrix Layout creates the program code.
 Your program is complete.







scan into Paint can be included in your program.

Matrix Helpmaker allows you to include an electronic manual in all your programs. Context-sensitive help windows, a table of contents, indexing, and the convenience of Hypertext functionality can now become a part of everything you create.

Finally, Matrix Desktop gives you the ability to organize your files and disks in a very Macintosh-like easy to see, easy to use way.

What's the cost? At just \$149.95 for the entire package, Layout speaks in a language you'll love to hear. Especially with our free customer support, no copy protection, and a 30-day, money-back guarantee.

#### Video Tape Offer

Our new demonstration videotape graphically illustrates how the many features of Matrix Layout will make a difference in your life. Call 1-800-533-5644 and order your VHS copy now (just \$9.95 for shipping and handling, credited against your purchase). In Massachussetts, call (617) 567-0037.

Do it today. Because once you see what Layout can do for you, we think you'll swear by it.

Circle 290 on Reader Service Card

Matrix Software Technology Corporation • One Massachussetts Technology Center • Harborside Drive • Boston, MA 02128 • (617) 567-0037

# The Right Tool for the Job

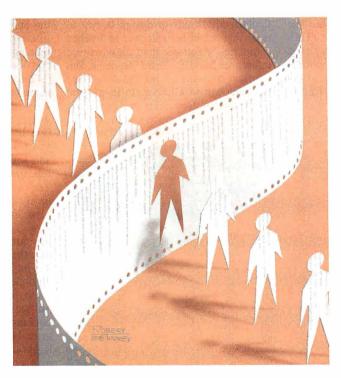
Even the systems design process falls within the realm of hypertext

Michael L. Begeman and Jeff Conklin

ypertext is an ideal model for the systems design process. We have been working on a hypertext project, the Design Journal, to provide a systems design team with a medium in which all of their work can be computer-mediated and supported. This includes such traditional documents as requirements, specifications, high-level design, and the design document itself; it also includes scenarios, design reviews, interviews with users, designers' early notes and sketches, design decisions and rationale, internal design constraints, meeting minutes, and so on.

The Design Journal places particular emphasis on capturing the *design rationale* as the center around which to integrate all the other documen-

tation. This rationale includes design problems, alternative resolutions (including those later rejected), trade-off analyses among these alternatives, and a record of the tentative and firm commitments made during problem resolution. We have built a running prototype of the Design Journal; it's based on the Issue-Based Information Systems (IBIS) method and is called gIBIS (graphical IBIS).



#### The IBIS Method

The IBIS method was developed by Horst Rittel (see reference 1) and is based on the principle that the design process for complex problems is fundamentally a conversation among the stakeholders (i.e., designers, customers, and implementers) in which they pool their respective expertise and viewpoints to resolve design *issues*. Any problem, concern, or

question can be an issue and may require discussion (if not agreement) for the design to proceed. In the IBIS model, this argumentation constitutes the design process.

IBIS focuses on articulating the key Issues in the design problem. Each Issue can have many Positions. A Position is a statement or assertion that responds to the Issue. Often Positions are mutually exclusive, but they needn't be. Each Position, in turn, can have one or more Arguments to support or object to it. Thus, each separate Issue is the root of a (possibly empty) tree; its children are Positions, and their children are Arguments.

There are nine kinds of links in IBIS. For example, a Position *Responds-to* an Issue, and this is the only place you can use the Re-

sponds-to link. An Argument either Supports or Objects-to its Position. Issues can Generalize or Specialize other Issues, and they can also Question or be Suggested-by other Issues, Positions, and Arguments. (The remaining two links are Replaces and Other.)

A typical IBIS discussion begins when someone posts an Issue node containing

a question such as "How should we do X?" That person can also post a Position node proposing one way to do X, as well as some Argument nodes to support that Position. Someone else can post a competing Position responding to the Issue and can support the Position with Arguments, and so on. New Issues that the discussion raises can also be posted and linked into the nodes that most directly suggested them.

There is no stopping rule, nor is there a particular way of registering Issue resolution by agreeing on some Position. The goal of the discussion is for each stakeholder to try to understand the elements of the others' proposals, and perhaps to change the others' minds. The method inhibits unconstructive rhetorical moves, such as argument by repetition and name calling, and supports more constructive moves, such as seeking the central issue, asking questions and giving answers, and being specific in supporting your own viewpoint.

In implementing gIBIS, some changes and extensions have been made to allow needed flexibility, but the method has been changed as little as possible. The extensions to IBIS in the current gIBIS tool are three: an additional Other type for nodes and links, as an escape mechanism when you can't find a way to express a thought within the IBIS framework; an additional External type for nodes that contain non-IBIS material,

such as requirements, documents, design sketches, or code; and the ability to let Positions specialize or generalize other Positions, and to let Arguments specialize or generalize other Arguments.

#### The gIBIS Tool

Three technological themes guided our design of gIBIS. First, we wanted to explore the capture of the rationale behind

he browser lets you see the IBIS graph structure, its nodes, and their interconnecting links.

the design. Second, we wanted to support computer-mediated teamwork, particularly the kinds of design conversations that might be held over networked computers, electronic mail, or news (see references 2 and 3). Third, we needed an application with an information base large enough to allow us to investigate the navigation (searching and browsing) of very large information spaces.

**Photo 1:** The gIBIS interface. Note the graphical browser (left), the structured index (upper right), the control panel below the index window, and the inspection window (lower right).

The pattern of gIBIS usage falls into two categories: Some people use the tool primarily as an isolated hypertext tool for structured thinking and design, while others use it primarily as a vehicle for structured communication.

The basic gIBIS interface is divided into four windows (see photo 1): a graphical browser on the left, a structured index into the nodes on the top right, a control panel below the index window, and an inspection window in which to view the attributes and contents of nodes and links. This interface is somewhat unusual among hypertext systems: To view the contents of a node or link, you must select it, and the contents will display in the inspection window.

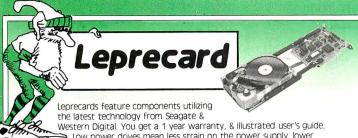
#### The Browser

The browser lets you see the IBIS graph structure, its nodes, and their interconnecting links. Most of it is dedicated to a local view of the network: a zoomed-in view of the current area of interest, with nodes and links in full detail. The lower-right portion of the browser contains a global overview: a zoomed-out view of the entire network without node labels, link-type icons, and secondary links. A rectangular overlay indicates the scope and position of the current local view.

You can scroll the browser window by using traditional scroll bars or by "snap scrolling" (clicking the mouse anywhere within the local view to center that location in the window). This method lets you fine-tune the position of the display and scroll diagonally without having to reposition two independent scroll bars. You can also scroll to an area outside the local view by repositioning the localview indicator in the global-view window. You simply drag the rectangle to a new area within the global view to update the local view.

The browser supports a direct-manipulation-style interface (see reference 4) to the display objects (nodes and links). You select a display object by clicking on it with the left button of your three-button mouse. The browser highlights and boxes it, puts its contents in the inspection window (see photo 1), and scrolls its index line to the top of the index window. A right-button mouse click displays context-sensitive menus that let you create, edit, delete, and move objects.

For example, if you press the menu button without selecting an object, a menu appears indicating that the only legal operation you can perform is Issue creation (i.e., the beginning of a new



Low power drives mean less strain on the power supply, lower operating temperatures, and longer component life. FREE SOFTWARE Including TakeTwo, the backup utility. PC MAGAZINE Editor's Choice in 1986 & 1987, & PC-KWIK disk cache software from Multisoft.

30MB 21MR 85ms 85ms

\$339

**30MB** 40ms \$389

40MB 70ms \$449

49MB 28ms\*

\$549

16ms\* \$649

65MB

Average access speed per partition TANDY 1000/A/SX/TX Leprecards add \$20

## LepreFAX Modems News

\$359

• Easy to use Pop-up Menus

\$299

- Sends ASCII or word processing files
- Send/Receive from any Group 3 fax machine
- Prints on standard dot-matrix or laser printers
- Automated sending during low phone rate periods

\$895

- Internal 4800bps, \$289 9600hns \$559
- Portable external plugs into PC serial port, \$359

### PC/XT Disk Kits

 Pretested & formatted • Western

\$299

- Digital short controller 30 page installation
- guide & reference manual · Cables, mounting screws,
- full & half-height face plates
- TakeTwo backup software,
- PC MAGAGINE "Editor's Choice"

   PC-KWIK disk cache software by Multisoft
- •1 year Warranty, 30 day Money Back Guarantee
- Optional: 150 watt. UL/FCC approved power supply for IBM PC's \$69

TANDY 1000 kits add \$20

**20MB kit** \$289 Seagate ST225 21.4MB/65ms/Half-Height/14.8 watts

30MB kit

\$309 Seagate ST238 32.7MB/65ms/Half-Height/14.8 watts

40MB kit

Seagate ST251 42.8MB/Half-Height/11 watts pre-formatted into a pair of 21MB/28ms partitions

65MB kit

\$549

Seagate ST277R 65.5MB/Half-Height/11 watts pre-formatted into a pair of 32MB/28ms partitions

### 28610 Computer

80286 processor at running at 6/10 Mhz with 0 wait states provides a Norton SI rating of 11.5. 8 slots Room for 1 full height and 3 half - height drives -200 watt power supply - Clock calendar - Choice of 1.2 or 1.44MB floppy drive - Combination Hard

Disk/Floppy drive controller - Maxiswitch 84 or 101 key Keyboard - 512K RAM standard expandable to 1 MB - Award BIOS - 1 year warranty - 30 day money back guarantee.

### Complete Systems with Serial/Parallel/Game Ports:

**\$1095** Monographics Card & Monitor \$1289 with 20MB/65ms Seagate \$1429 with 40MB/40ms Seagate with 65MB/40ms Seagate \$1549

Orchid 512K VGA & Multisync II \$1995 \$2189 with 20MB/65ms Seagate \$2329 with 40MB/40ms Seagate

with 65MB/40ms Seagate

\$2449

### 1.5 MB Laser Printer

"One of the Laseriet's strongest competitors." INFOWORLD October 5, 1987

512K RAM

15MB RAM

\$1495

\$1595

- •100% HP Laseriet. & Laseriet + compatible
- •1.5MB RAM Gives Full Page 300dpi graphics
- Vector graphics capability improves speed on programs like Autocad up to 93%
- 9 resident & 5 downloadable soft fonts standard



- Serial & Parallel Interfaces •120 day TRW on site maintenance
- 1 year Warranty
- Options: All HP style font cartridges Toner Cartridge \$29

### AT Hard Disk Kits

- Includes IBM AT rails & cables
- SpeedStor or OnTrack large drive software
- Formatted, Partitioned & Tested

Size	Model	Speed	Capacity	Price
HH	Seagate ST251	40ms	42.8MB	\$359
HH	Seagate ST251-1	30ms	42.8MB	\$449
FH	Seagate ST4096	28ms	80.2MB	\$599
FH	Maxtor 1140	27ms	117MB	\$1669
FH	Maxtor 2190	30ms	150MB	\$1999

### Orchid

Designer VGA 512K **\$299** 256K **\$269** 

Tiny Turbo 286 **\$289** 

Ramquest II 1MB \$799



### 3.5" Floppy Kits

include 51/4" mounting bracket, black & gray face plates, and AT rails. 1.44 MB for PC/XT includes high speed Western Digital controller, FREE TAKE TWO floppy backup software.

720 Kit \$109

\$139

1,44MB for AT 1,44MB for PC/XT \$199

### 2400 MNP Modems \$239/\$229

- Hayes Compatible, 300/1200/2400
- MNP level 4 error correction
- FREE MIRROR II Software, a \$69 value
- Internal model \$229, fits in short slot

Internal with MIRROR II (non MNP) \$109



2524B Townsgate Rd, Dept. B / Westlake Village, CA 91361

To order, or get our free catalog, call:

Toll Free 800-722-AT-XT California

805-373-7847

- ★ No extra for Visa/Mastercard (AMEX add 3%).
- \* Prices include UPS surface shipping.
- \* Federal Express shipping just \$1.50 per pound.
- \* 30 Day Money Back Guarantee.
- \* Corporate & Institutional PO's accepted.

IBIS structure). By contrast, if you select an Issue node, the menu changes to reflect the legal operations on Issues. If you create a follow-up Position node, it is placed next to the Issue and linked to it with a Responds-to link. Then, the inspection window divides in half and a Node Creation window preloaded with a structured template appears beneath it.

You fill in the template's structured fields (e.g., Subject, Keywords, and so forth) and provide an optional description of the node's topic (i.e., an unstructured node body). When the node is complete, you push the Submit button in the control panel (which appears only during Node Creation and Editing); the node is then parsed and stored, and the browser and index windows are updated to include it.

When you follow the "Link to another node" menu item, you can choose from the set of legal outgoing link types for the current node, and the new link appears stretching between the source node and the current mouse position. You move the mouse to the destination node (by "rubber banding") and then drop the end of the link there.

You can also select canonical IBIS subnets (i.e., a single Issue followed by its Positions, and their Argument nodes) as a single entity. The gIBIS tool supports the movement and automatic layout of these subnets as wholes. Further, it lets you gather a subnet into a single composite Issue-Position-Argument (IPA) node; this node provides additional

structure to analyze competing Positions and commit to one of them (Issue resolution).

While it has a structure and body all its own, the IPA node by default inherits its label, subject, and keywords from the root Issue of the underlying subnet. Selecting the composite means traversing the underlying subnet and composing an "inherited" body, which is shown in the

he nodeindex window provides an ordered, hierarchical view of the nodes in the current network.

inspection window along with any composite-specific text (see figure 2). Since the inherited body can become quite long with a large subnet, a function key lets you suppress (or reveal) it in the inspection window.

### The Node-Index Window

The node-index window provides an ordered, hierarchical view of the nodes in the current network. To traverse the network, you follow Primary links in depth-

first order starting from each Issue. The Issues, Positions, and Arguments are given sequence numbers like you might find in an outline editor (see reference 5). For example, the Subject line for Issue 8 is I.8; it has no children, so that's all there is. The Subject line for Issue 9 is I.9; its first Position node (P.9.1) has two Argument nodes (A.9.1.1 and A.9.1.2), and so forth. Issues are ordered by creation date. The view-configuration panel lets you tailor the index to reflect by Subject, Author, Keyword, or node Label.

You can select nodes through the index as well as the browser. Clicking on a node's index line makes that node current: Its icon is highlighted in the browser, the window is scrolled, if necessary, to bring it into the local view, and its contents appear in the inspection window. This browsing method provides a linear, compressed view of the data in the network.

### **The Control Panel**

The control panel is composed of a set of buttons that extend gIBIS's functionality beyond simple node and link creation. Each button hides a menu that extends or tailors its basic function. The Next button, for example, normally records that you have read the current node before it displays the next one. But if you press the right-hand mouse button while over the Next button, the hidden menu will appear. This is a slight extension of basic

IBIS (Internal release 3.0) Issue tool - 9/22/87 ?? Definition ?? Jeff's log Revals log / 🖸 ← Node Str A! Move subnet Layout subnet Aggregate subnet A! Deselect Ρ. P. A! A! IBIS 1 ?/Issue (a)

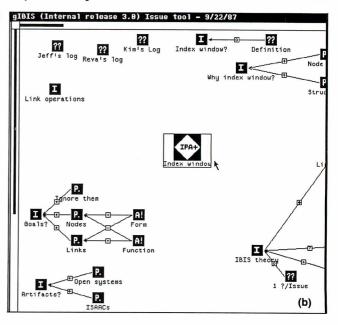


Figure 1: A canonical IBIS subnet (a) before and (b) after aggregation. Since the "inherited" body can be quite long in a large IBIS subnet, a function key lets you suppress or reveal the inherited text body in the inspection window.

# With Modems you can Get Smart ...or Get Smarter



List Price

# The Next Generation in Modems

■ FAST . . The ATI internal 2400 Baud PC modem uses data compression techniques providing data throughput speeds in excess of 4800bps.

- ERROR FREE . . Uses high level MNP5 hardware error correction procedures to guaranty 100% error-free data.
- **DEPENDABLE**.. Built by the manufacturer of the world famous **EGAWONDER** graphics cards, the 2400etc has full compatibility with popular communication software.
- SMART . . Every modem includes a FREE copy of Mirror II communications software which allows users background tasking for receiving Electronic Mail or Data transfers concurrently with screen applications.

Suggested

Smart price to pay for Smart technology

AVAILABLE FROM LEADING COMPUTER DEALERS.





Technology you can Trust. ATI Technologies Inc., 3761 Victoria Park Ave. Scarborough, Ontario, Canada M1W 3S2 Tel: (416) 756 0711, TIx: 06-966640 (ATI TOR) Fax: (416) 756-0720 ATT is a registered trademark of ATT Technologies Inc. MNP is a trademark of Microcom Corporation. Mirror II is a trademark of Softklone Distribution Corporation Crosstalk - Digital Communications Associates Inc. Smartcom II - Hayes Micro Computer Products Inc.



### **Problems in Paradise**

O ne common but subtle difficulty in hypertext systems is that sometimes it's unnatural to break your thoughts into discrete units, particularly if you don't understand the problem well and those thoughts are vague, confused, and shifting. With gIBIS, this effect is pronounced, because the IBIS method imposes on you a rather austere selection of node and link types; gIBIS makes you think within a particular framework (i.e., you focus on Issues without necessarily resolving them), and this can be disruptive.

The early phase of considering a writing or design problem is critical and fragile and must be allowed to proceed in a vague, contradictory, and incomplete form for as long as necessary (see references 1 and 2). However, any insights should be captured, and gIBIS should support the emergence of a coherent structure as it develops.

Design conversations often feature commitments like "Let's try X—it has advantage Y." This is a Position and a supporting Argument, but no Issue is mentioned. Since you don't always see the Issue or Position immediately, it would be nice to have a "proto-node" in which to record ideas, snippets of text, and perhaps graphical sketches before having to structure them.

Ultimately, of course, it's valuable to have separated these elements into Issues, Positions, and Arguments. But when you're struggling to solve a problem, the mental effort required to separate it into discrete thoughts, identify their types, label them, and link them can be prohibitive.

### Finding the Right Answer

In the IBIS method, you resolve an Issue by selecting one of the Positions that respond to it as being "the right answer," or at least "the Position we are committing to for now." You could mark the Position node as Selected and display it by marking such nodes distinctively in the browser, perhaps with a somewhat different color.

We have recently added an Issue resolution feature to gIBIS. It combines indicating resolution with the aggregation into Issue-Position-Argument nodes; once an Issue is part of an IPA node, you can resolve it. At the moment, you change the value of the Resolved field to

True and indicate which Position holds the resolution.

The rationale for adopting a particular conclusion may require more explanation; for instance, perhaps all the argumentation didn't occur within gIBIS. Sometimes, resolving an Issue transcends the original options. Such resolutions may combine elements of the original options and abandon prior assumptions or presuppositions. Sometimes, when a breakthrough occurs, it's clearly the right solution.

The gIBIS tool needs to allow such leaps in argumentation and not force the Issue to a well-structured resolution. This may be as simple as providing the free-text annotation of an IPA tree or the marking of some discussions as "irrelevant in light of Position X."

### Getting the Whole Picture

Using hypermedia for cooperative work has its problems as well. Sometimes, an unexpected problem can emerge when several users work cooperatively in a shared Issue group. Unless each author writes clearly and completely, while you might understand the individual nodes, it's hard to follow the thread of thoughts as it winds through several dozen nodes. That is, the hypertext tool forces the author to express ideas in a fined-grained, separated manner, and this obscures the larger idea being developed.

This is a familiar problem common to many hypertext systems: The freedom of choice inherent in branching documents requires greater care from both the author and the reader. The separation of Position and Argument in IBIS (i.e., an idea and its justification) could also be another factor.

However, there may be a more subtle issue here: Traditional linear text provides a continuous, unwinding context thread as ideas are proposed and discussed—a context that the writer constructs to guide you to the salient points and away from the irrelevant ones. Indeed, a good writer anticipates questions and confusions that you may encounter and carefully crafts the text to prevent them.

The hypertext (or at least the gIBIS) author, however, is encouraged to make discrete points and separate them from their context. Sometimes, the gIBIS au-

thor, in a hurry to capture a design Issue and its analysis, may write only the bare minimum necessary to record the essence of the Issue, Positions, and Arguments. Even the careful author, however, may not anticipate all the routes to a given node, and so may fail to develop the context sufficiently to clarify its contents.

Using a path may linearize a network's segments sufficiently to provide context (see references 3 and 4). And there are higher-level constructs that aggregate a set of nodes. The new IPAnode type combines all of an IBIS subtree's nodes (an Issue, its Positions, and their Arguments) into a single node and lets you append additional IPA-specific text as well. This linearizes the discussions of individual Issues and reduces the sense of fragmentation you sometimes have when reading a gIBIS network, but it's probably not sufficient to restore the context in which those nodes were created.

Finally, part of the context is the relative importance of the points presented, and we need to incorporate an "importance" meter into gIBIS nodes. One possibility would be to incorporate one of three keywords, HI IMPORTANCE, MED IMPORTANCE, or LO IMPORTANCE, into each node at creation. This would guide you to the most salient points first (see also reference 5); it could also be used to control the level of clutter in the browser display.

### Staying on Track

It's common in conversations to "go meta" and make a comment on the *process* (as opposed to the content) of the discussion (i.e., "But that isn't the issue here"). Similarly, in IBIS discussions, sometimes you need a meta-discussion when one person in an Issue group feels that another has misused the IBIS structure to present ideas. For example, if B feels that A's Issue node is actually two Issues and a Position, B needs a way to express this and to initiate a discussion about it.

There are three levels of collaborative work: *substantive* (the content of the work), *annotative* (comments about substance), and *procedural* (comments about procedures and conventions) (see reference 4). In IBIS, you can theoretically treat all three levels as Issues. For

example, B could post an Issue, connected by a Questions link to A's Issue, asking "Isn't this really two Issues and a Position?" While this is a valid move, it has drawbacks.

B's Issue is by its nature meta-substantive, although whether it's annotative or procedural is unclear. But by placing it in the network, B creates an Issue that adds complexity to the browser display without shedding any light on the problem being discussed; B also initiates a discussion that may change the network, after which this meta-discussion will have only historical interest.

This problem has several resolutions. You could have special meta-level Issue, Position, and Argument nodes to distinguish them from substantive ones. Or you could label nodes as "only of historical interest." Such nodes could be archived or have their display suppressed so they wouldn't normally be visible. You could also give each node its own meta-layer (only displayed on request) for such discussions. In a simple version of this option, you can append a meta-line at the end of any gIBIS node and then begin an annotative or procedural discussion there. The node's author might append a response or revise the network to correct the structural error.

### **Lost and Found**

A hot issue in hypertext research is how to use a graphical browser effectively to navigate networks with more than a few dozen nodes. This is part of the more general problem of disorientation, particularly its visual and spatial aspects in a large data space. Although gIBIS has addressed this problem with its globalview and query mechanisms, many hypertext systems have not.

### **Keeping Current**

Any database must be able to manage changes to its data. Often, a versioning scheme that allows older versions of the data to be marked and archived is used. In gIBIS, the issue of change is of unusual importance, because the very nature of an "Issue base" is its use for evolving discussions in which older material may be accurate and highly important, inaccurate and of only historical interest, or anything in between. For example, the original form in which an Issue is framed may be biased toward a particular Position, or it may contain a presupposition that is later made explicit and rejected. How can you handle this "outdated" form of the Issue?

Sometimes, the Issue and its discussion subnet may be isolated and wrong; then it's easy to decide to archive that subnet and delete it. But more often, parts of the subnet will be wrong, misleading, or irrelevant, while others are still relevant or important and part of an active region of the network. How do you prevent these partially invalid segments from poisoning the network?

Perhaps you could systematically indicate the age and relevance of network material by, say, displaying older nodes as yellowed or frayed (unless they have been recently visited and updated). Like importance, salience, and confidence, age and relevance are somewhat subjective measures and can be only partially automated. Another possibility for managing change is completely human: As Issue networks grow in size and importance, organizations should have people whose job is to maintain the currency and consistency of the Issue base.

### REFERENCES

- 1. Brown, J. S. "Notes Concerning Desired Functionality, Issues and Philosophy for an AuthoringLand." Xerox PARC CIS Working Paper, 1982.
- 2. Smith, John B., Stephen F. Weiss, Gordon J. Ferguson, Jay D. Bolter, Marcy Lansman, and David V. Beard. "WE: A Writing Environment for Professionals." Technical Report 86-025, Department of Computer Science, University of North Carolina at Chapel Hill, 1986.
- 3. Bush, Vannevar. "As We May Think." Atlantic Monthly, July 1945, pp. 101-108.
- 4. Trigg, Randall, Lucy Suchman, and Frank Halasz. "Supporting Collaboration in NoteCards." Proceedings of CSCW '86: The Conference on Computer-Supported Cooperative Work, MCC/STP, Austin, Texas, December 1986.
- 5. Lowe, David G. "Cooperative Structuring of Information: The Representation of Reasoning and Debate." International Journal of Man-Machine Studies, vol. 23, 1985.

functionality and leaves the current node marked unread.

For those functions with no extensions, the menu provides a longer explanation of the button's functionality. For example, the Goto button loads a particular Issue group's data into the browser; it hides a Help menu that tells you to "enter an Issue group name and push this button."

The Misc button hides a grab bag of functionality. For instance, the Tool Config item lets you tailor particular aspects of the interface. If you select it, a new window appears that contains the gIBIS configuration parameters, their current settings, and any constraints on their legal settings. These parameters are divided according to whether they affect the index, the browser, or the inspection window.

### Primary and Secondary Links

When a node is created, it's usually automatically linked into the existing network of nodes. This automatic first link is its primary link. Later, you may connect that node to others in the network. but all subsequent links are secondary and differ from the primary one both visually and navigationally.

Filtering out the secondary links from a canonical IBIS subnet results in a hierarchy that becomes the basis of the index window's structured listing. For example, let's say that three Positions respond to an Issue, and two of them have supporting Arguments. The Positions are mutually exclusive, so each Argument also objects to the other Positions; hence, secondary links make these connections explicit.

It's easier to understand the IBIS network if, on first pass, the browser displays only the primary links and "turns off" the secondary links. The Next button leads you through the network in the canonical IBIS order (the same sequence as the index window). The primary-link view shows clearly how the current node relates to the surrounding conversational structure. After the first pass, you can make the secondary links visible, if you wish, to see the cross-relationships encoded in the network. (In keeping with the design philosophy of tightly coupled windows, selecting a node with the Next button causes the same scrolling and highlighting as selection via the browser or index window.)

### The Use of Color

We designed gIBIS for use on Sun workstations with color monitors. Thus, color is used to indicate node- and link-type information, as well as such special node states as "currently selected" and "matches the current query." You can also configure gIBIS to customize the color mapping.

This flexibility caused some trouble at first, and we quickly added a set of standardized color mappings. Having colored nodes and links turns out to be one of the most compelling aspects of gIBIS. You can quickly learn the type mappings for the most commonly used nodes and links, and type identification then becomes a rapid, reflexive activity. While you may occasionally change your mappings with the Tool Config panel for special purposes (like making some links invisible for presentations), most users commonly set up their colors and leave them alone.

If you have a monochrome monitor, the information encoded by color is duplicated with icons. While gIBIS by default presents both color and icons, both can also be suppressed. Usually, the color-monitor user suppresses the link icons to make the browser view appear less cluttered.

Using color presents its own set of problems, however. For one, you must have a color display. And you are limited to a small number of color mappings. The gIBIS tool contains nine link types and is probably near the limit of people's ability to reliably perform the mapping. By adding the link-type icons, the mapping complexity drops, and more link types could be safely added.

More surprising, however, is the large machine-to-machine variation among color monitors in overall brightness, convergence, and RGB-gun saturation. This variation has eliminated the possibility of using a single, standardized set of color mappings for all machines. The color settings that produce bright, highly defined images on one screen can be dark, muddy, and indistinct on another. To address this, the four sliders at the bottom of the Tool Config window let you fine-tune the color map to your machine.

### Search and Query

Another control-panel feature is the Query button. Pressing it brings up a small query-construction window. It contains a small control panel and a specification section for "query by example," which lets you create a protonode against which the nodes in the current IBIS net will be matched. When you press the Execute button, the query is parsed and evaluated, and its results displayed in both the browser (selected nodes turn a bright yellow in both the local and global views) and the index window (the window shows only the index lines for those nodes satisfying the query).

You can then examine those nodes using standard navigation techniques. Pressing the Help button reveals another window (obscuring the browser window), which contains instructions on how to formulate queries, their appropriate grammar, and a number of examples.

This query-specification technique lets you formulate node-content searches based on the logical AND of predicates over node attributes. The grammar could be extended to allow full Boolean expressions over the predicates, but there has been little demand for it. These more sophisticated queries may be required when the networks become very large, but the simple query engine in gIBIS is

and Compare Our Quality and Prices

100% IBM Compatible

# 12 MHz 286 EGA Color System

- · Samsung 14" EGA Color Monitor
- 12 MHz PC-AT Computer, 0/1 Wait State Selectable
- · AT Case with Key Lock, Turbo, Power and Hard Drive LEDs
- Enhanced Auto Switch EGA Card Intel 80286 CPU
- Multi-speed 6/8/10/12 MHz

TEEE

- · Keytronics 101 Enhanced Keyboard
- 640k Memory Expandable to 1 Meg 200 Watt Power Supply
- Seagate Model ST251 42+ Meg Hard Disk Drive
- 51/4" 1.2 Meg Floppy Drive
- Western Digital 2 Hard Disk & 2 Floppy Controller with Cables
- Serial / Parallel & Game Port Complete Operations Manual
- One Year Warranty 80287 Math Co-Processor Slot

With Monochrome / MGA + 40 Meg ..... \$1550

With Monochrome / MGA + 20 Meg ..... \$1395

### IEEE 20 MHz 386 EGA **Color System**

- Samsung 14" EGA Color Monitor
- · 20 MHz 0 Wait State Computer
- Enhanced Auto Switch EGA Card
   AT Case with Key Lock, Turbo, Power and Hard Drive LEDs
- Intel 80386 CPU Multi-speed 9.6/21.0/26.7 Landmark
- Keytronics 101 Enhanced Keyboard
- 1 Meg. 100ns Memory 200 Watt Power Supply
   Seagate Model ST251 42+ Meg Hard Disk Drive
   5¼ 1.2 Meg Flopny Drive
- 5½ 1.2 Meg Floppy Drive
   Western Digital 2 Hard Disk and 2 Floppy Controller with Cables Serial / Parallel & Game Ports
- Complete Operations Manual One Year Warranty
- Math Co-Processor Socket

**\$**3095

With Monochrome / MGA 12" .....

Terms: One year warranty (12 mo. parts / 6 mo. labort, 30 day money-back guarantee (excluding shipping charge). Visa, MasterCard, Discover (add 3% for credit cards), cashier's check money order, wire transfer, personal checks personal checks allow 10 working days to clear) accepted. Shipping & insurance extra. Prices & availability subject to change without notice. IEEE reserves the right to substitute equivalent or better products. No CODS: 15% restocking fee on unauthorized returns. IBM XI/AT are trademarks of IBM Corp. HOURS: (Central Time) 9 a.m.-7 p.m. Mon.-Fri., 9 a.m.-5 p.m. Sat.

### IEEE Super Turbo XT — 10 MHz

- 10 MHz PC-XT Computer
- AT Style Case with Key Lock, Turbo, Power and Hard Drive LEDs 4.77 / 10 MHz Motherboard
- Keytronics 101 Enhanced Keyboard
- 256K Ram Stnd. Expandable to 640K
- Serial / Parallel & Game Port 150 Watt Power Supply
- 360 Floppy Floppy Controller & Cable Hercules Comparable Graphics Card
- One Year Warranty Complete Operations Manual

With 12" High Resolution

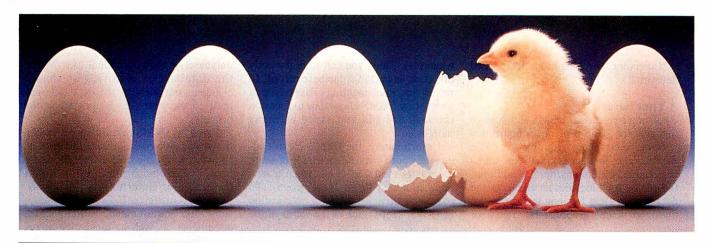
Monochrome Monitor ...... Only \$625

To Order, Call:

1-214-931-3777

ieee, inc. 17120 Dallas Parkway Suite 212 • Dallas, Texas 75248

# TRY THE NEW GENERATION FOR \$30



### **KNOWLEDGEPRO**

KnowledgePro uses Topics to store "chunks of knowledge." Topics can contain data, hypertext, procedures, calculations, rules, lists and pictures. Using a dozen simple commands, non-programmers can use topics to explain complex procedures, rules or recommendations. Using the other 100 plus commands, professional programmers can create sophisticated expert system tools and applications quickly and easily.

### **HYPERTEXT**

Hypertext can be a powerful tool for organizing text, graphics and data, but without an underlying structure the user becomes lost in a maze of information. KnowledgePro adds structure, control and intelligence to create an exciting new teaching medium.

## Once you've used KnowledgePro you'll never go back to your shell!

### Q. Who's using it?

A. Engineers, Educators, Lawyers, Scientists, Managers, Authors, Bankers, Software Developers, Expert System Developers, Computer VARs and VADs, Trainers, Consultants, Experts in Agriculture, Manufacturing, Insurance, Petroleum, Government and many many more.

### Q. What are they doing with it?

A. Intelligent tutorials, smart manuals, procedure guides, rule books, computer aided instruction, sales and promotion, data analysis, non-linear documents, text analysis, diagnostics, software front-ends, expert systems, training and education, hypertext authoring, case studies, insurance claim determination, investment analysis, intelligent forms there seems to be no limit to the diversity of applications.

### Q. What can I do with the demo system?

A. The KnowledgePro demonstration system comes with a 100 page manual and lots of examples to get you started. You can create and save small working knowledge bases. The only commands that you can't use are those for handling external files or chaining knowledge bases. We even credit your \$30 toward the cost of the full system.

### Q. How much is the full development system?

A. KnowledgePro costs \$495 and there are no run-time charges, so you don't have to pay more when you distribute your applications. The Database Toolkit (for access to dBASE and Lotus 123 files) costs \$49 and the Graphics Toolkit (for access to PC Paintbrush pictures) costs \$89. Our KnowledgeMaker induction system (for creating rules from data) costs \$99. KnowledgePro runs on IBM PC, AT and PS/2 compatible machines with 640K memory.

TO ORDER Call 518-766-3000 (Amex, Visa, M/C accepted) or send \$30 + \$5 shipping & handling for the demo (\$38 total foreign) or \$495 + \$8 shipping & handling for the full system (\$553 total foreign) to Knowledge Garden, Inc., 473A Malden Bridge Road, Nassau, NY 12123. In NY State please add 7% sales tax.

# **KnowledgePro**

By Bev & Bill Thompson The first Knowledge Processor. published



association



KnowledgePro is a registered trademark of Knowledge Garden, Inc., Lotus 123 is a registered trademark of Lotus Development Corp., dBASE is a trademark of Ashton Tate. IBM is a registered trademark of International Business Machines Inc., KnowledgeMaker is a trademark of Knowledge Garden Inc. Photo Tcherevkoff (

sufficient for searching moderately sized networks.

### A Time Saver

Choosing a relational DBMS as a storage manager for gIBIS provides concurrency control, record-level locking, reliable data storage, fast access methods, and a reasonable search engine. In addition, the one we used includes an uninterpreted data type (a field for long text passages, digitized voice, graphics bit maps, or whatever). Thus, you can store the body of a node as part of a database record. In retrospect, implementing gIBIS on top of an existing DBMS allowed us to focus on the task at hand and saved us many months.

Unfortunately, the DBMS doesn't adequately notify you when a table or set of records is modified (e.g., when a new node is added to an Issue group). To overcome this, we added a notification layer that keeps track of the status of the

database for each individual user. When the database is modified so that it changes your view of the data, you are notified and your view is updated appropriately.

Using a DBMS presents one major drawback, however: It closes the system. In essence, all the objects that the Issue networks reference must reside within the database. Unfortunately, many objects that instigate Issue-based discussions, like requirements or architecture documents, as well as those objects resulting from these networks, such as code and documentation, are external to the database. A special *surrogate* type of node lets gIBIS reference external objects, such as text, graphics, or spreadsheets, in a "blind faith" sort of way.

A surrogate has two parts: a pointer to the external object (usually a fully qualified path name) and the name of an optional display program that gIBIS should invoke to display the object. If you don't specify a program name, the default display program assumes that the external object is a text file and loads it into the standard inspection window. If you specify a display program, gIBIS invokes it and passes it the external path name as an argument.

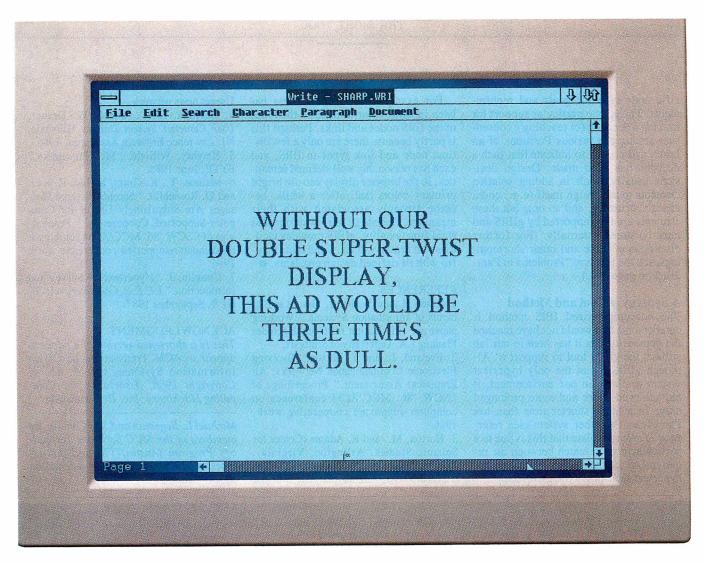
### A Useful Structure

IBIS is a powerful method for research thinking and design deliberation. If you're working alone, the Issue-Position-Argument framework helps to focus your thinking on the hard, critical parts of a problem and to detect incompleteness and inconsistency in your thinking. If you're collaborating in an Issue group, the structure gIBIS imposes on discussions is useful and exposes axe grinding, hand waving, and clever rhetoric. It has a tendency to make assumptions and definitions explicit.

You can trace some of these advantages to the semi-structured nature of IBIS networks (see reference 6). The writer can structure a complete message without any constraints on what is said, while the reader has a recurrent structure in the text that aids search and comprehension. The explicit rhetorical structure of IBIS reveals at least the general structure of an unfolding discussion. Indeed, a distinct advantage stems from the particular structure that IBIS provides. That is, a good match exists between some of the cognitive structures and processes of design and the three node types and nine link types that compose IBIS.

However, we have found some major shortcomings in gIBIS. There is no spe-





If it weren't for Sharp's new technology, chances are you'd still be trying to read the headline above. That's because our display screen offers unsurpassed brightness and clarity, with three times the contrast of conventional LCDs. Along with an increased viewing angle, our double super-twist display provides an image quality which approaches that of a printed page.

What's more, Sharp is the first to successfully develop and mass-produce this technology—

which means we have DST of the first hand-held calculators, displays available now in Sharp has been an innovative

quantity. Each unit is fitted with a durable CCFT backlight for bright, clear display. And each offers low drive

voltage, low power consumption, and fewer temperature-dependent tone variations.

Since the days SHAF

SHARP'S DOUBLE SUPER TWISTED DISPLAYS VIEWING DOT DOT OUTLINE **FORMAT** DIMENSIONS **AREA** SIZE MODEL# WxHxD (mm) WxH (mm) WxH 0.49x0.49 LM24010Z 240x128 176x96x22 134x76 LM64135Z 640x400 300x166x26 218x139 0.30x0.30 0.28x0.28 LM64148Z 640x480 280x180x25.5 205x155 LM64048Z 640x480 310x240x25 237x180 0.33x0.33 LM72060Z 720x400 320.4x170.4x34 260x147 0.32x0.32

> leader in LCD displays. To find out more about our new double super-twist units, call

> > (201) 529-8757.

IF IT'S SHARP, IT'S CUTTING EDGE.

cific node type for goals and requirements. There is no particular support for making a decision (or reaching a consensus) among the various Positions of an Issue, and no way to indicate that such a decision has been made. Design decisions usually result in adding solution elements to the design itself (e.g., code, module structure, and so on), but these elements are not supported by gIBIS and must be stored externally. (For further discussion of these and other shortcomings, see the text box "Problems in Paradise" on page 260.)

### A Synergy of Tool and Method

The noncomputerized IBIS method is cumbersome and would not have reached the popularity that it has here in our lab without the gIBIS tool to support it. Although gIBIS is not the only hypertext system available in our environment, it has achieved wider and more prolonged usage in a much shorter time than has PlaneText, the other system (see reference 7). We speculate that this is due to a particularly good match between the requirements of the IBIS method and the hypertext facilities of the gIBIS tool.

For example, one clear success has been in using color to indicate the types of the IBIS nodes and links. Perhaps this is partly because there are only a few distinct node and link types in IBIS, and each has reasonably well-defined semantics, so the browser display can use bright primary colors that, after a while, become strongly associated with their meanings. Despite its narrow design and rigid functionality, gIBIS provides facilities that are easy to learn and quite helpful with ill-defined design problems.

### REFERENCES

- 1. Rittel, H., and W. Kunz. "Issues as Elements of Information Systems." Working paper no. 131. Institut für Grundlagen der Planung I.A. University of Stuttgart.
- 2. Eveland, J., and T. Bikson. "Evolving Electronic Communication Networks: An Empirical Assessment." Proceedings of CSCW '86: MCC/ACM conference on computer-supported cooperative work, 1986.
- 3. Horton, M., and R. Adams (Center for Seismic Studies, Arlington, Virginia). "How to Read the Network News." Distributed by Mr. Adams quarterly over the

Usenet news network.

- 4. Norman, D. A., and S. W. Draper. *User Centered System Design*. Hillsdale, NJ: Lawrence Erlbaum Associates, 1986.
- 5. Hershey, William. "Idea Processors." BYTE, June 1985.
- 6. Malone, T., K. Grant, K. Lai, R. Rao, and D. Rosenblitt. "Semi-Structured Messages Are Surprisingly Useful for Computer-Supported Cooperation." Proceedings of CSCW '86: MCC/ACM conference on computer-supported cooperative work, 1986
- 7. Conklin, J. "Hypertext: A Survey and Introduction." *I.E.E.E. Computer*, vol. 20, no. 9, September 1987.

### ACKNOWLEDGMENT

This is a shortened version of a paper to appear in ACM Transactions on Office Information Systems, vol. 6, no. 4. Copyright 1988, Association for Computing Machinery, Inc. By permission.

Michael L. Begeman and Jeff Conklin are members of the MCC Software Technology Program (Austin, TX) and the authors of gIBIS. They can be reached on BIX as "editors."

## It's the Dawn of the Information Age...

The centerpiece of the **Flyspeed Collection** is **st/exp**, the brainchild of our resident Westinghouse Science Talent Search winner and Caltech alumnus, Thomas Fly. (Charles Townes, a Caltech alumnus from neighboring Greenville, SC, won the Nobel Prize for the laser. In the 1930s, another Caltech alumnus invented xerography, which, combined with the laser, put that laser printer in your office—if you're wondering why all the laser printing engines are made in Japan, ask an alumnus of the Harvard-genre of American business schools.)

Even on your 5-year-old IBM PC (that runs Borland's Turbo Lightning at an astounding 8 words per second), st/exp compresses text files at rates of over 500 wps (1000 wps for expansion), typically to 30% or less of their original size, allowing faster modem communications and more efficient data storage.

Other FlySpeed programs include: **Typing Demon.** Named after Maxwell's Demon from thermodynamics, it

plus several other utilities

Do you know where your Optimal Representation of Language is?



### MicroComputer Square

126 Hancock Avenue Spartanburg, S.C. 29302 (803) 583-9655 is a spin-off of our work on communication aids for the handicapped. Typing Demon currently works with Wordperfect, Microsoft Word, and Sidekick, to put 14 common wordprocessing functions under your fingertips; automatically space after punctuation; automatically capitalize sentences; allow you to type common words and suffixes with a single keystroke, and define abbreviations for less common words (i.e., "b" = because). Typing Demon automatically invokes st/exp to compress and archive your documents when you leave your word-processor.

your word-processor.

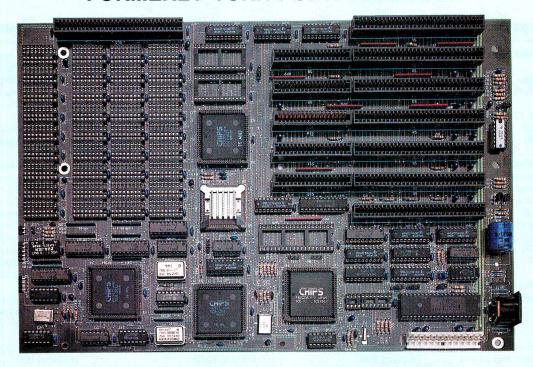
The FlySpeed Collection, presently priced at \$75 (a demo set is available for \$15), will increase to \$95 when Merlin, an indexed text-retrieval program based upon Fly Coding, becomes available in January. Current users will receive the update at no ad-

ditional cost.

The FlySpeed Collection makes an excellent addition to the Caltechnology you didn't know you already have. It comes with a 60-day money-back guarantee.

# ACCU-SYS

### FORMERLY TURN-POINT AMERICA



# 80286 16 Mhz 0 WAIT STATES

Itilizes the "NEAT" chin set to achieve performance that exceeds some

	Norton SI 18.0). Accepts either 1 Mb or 256k DRAM chips (dual sockets)	
	DRAM. Software and hardware switchable between 6/8/12/16 Mhz.‡	\$700
80386-20/25 Mhz	With optional RAM cashe memory to increase through put by 25 %.*	Avail. by mid Oct.
80386-20/25 Mhz	0 wait state, Norton SI 28.0, dual sockets for up to 16 Mb of DRAM.*†	\$896
80386-16/20 Mhz	0 wait state, Norton SI 23.0, dual sockets for up to 16 Mb of DRAM.*†	\$819
80286-6/12.5 Mhz	0 wait state, Norton SI 15.3 dual sockets for up to 4 Mb of DRAM.‡	\$345
VGA Card 100%	register compatable with IBM, resolution up to 1024x768x16 colors.‡	\$275
Super Multi I/O	FD controller for 1.44 Mb thru 360k, 2 serial, 1 parallel, 1 game port.	\$89

Dealer and distributor inquiries are welcome, an aggressive price structure is offered to qualified dealers. All **Accu-Sys** products carry a 1 year parts and labor warranty. Visa, MasterCard and COD accepted.

\*8/10 Mhz software switchable I/O bus and supports 80287, 80387 and Weitek processors.

†without CPU or DRAM, please call for current prices. ‡without RAM, please call for current price.

## Sales 1-800-247-6413 Tech Support (702) 746-1818



Circle 291 on Reader Service Card

Accu-Sys eclat corporation 3495 N. McCarran Blvd. P.O. Box 41334 Reno, NV 89504 Telex: 650 308 4898 MCI

Fax: (702) 746-2306

TRADEMARKS and REGISTERED TRADEMARKS: IBM — International Business Machines

## Hyper Activity

### HYPERTEXT PRODUCTS

Business FileVision ...... \$395
Macintosh
Marvelin Corp.
3420 Ocean Park Blvd.
Suite 3020
Santa Monica, CA 90405
(213) 450-6813
Inquiry 958.

**Document Examiner** 

Feature of Genera software environment that comes bundled with Symbolics workstations Symbolics, Inc. 11 Cambridge Center Cambridge, MA 02142 (617) 621-7500 Inquiry 957.

Graphic KRS (Knowledge
Retrieval System) \$400
Workstations
Text KRS \$300
Workstations
Hyper KRS \$3000
(includes 1 Hyper Indexer and 10 Hyper KRS)
Additional workstation copies \$125
Knowledgeset Corp. 60 Garden Court, Building A
Monterey, CA 93940
(415) 968-9888
Inquiry 963.

Guide

HyperCard......\$49
Mac Plus, SE, and II
Apple Computer, Inc.
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010
An assortment of public domain
stacks for HyperCard is available
on BIX in the "stackware" area
of the "listings" conference.
Inquiry 960.

Commerce Court, Suite 240 4 Station Square Pittsburgh, PA 15219 (412) 281-5959 Inquiry 961.

MacSMARTS....\$195
Mac 512 or higher
MacSMARTS
Professional....\$495
Mac 512 or higher
Cognition Technology Corp.
55 Wheeler St.
Cambridge, MA 02138
(617) 492-0246
Inquiry 964.

Marcon, a DBMS with hypertext-like indexes.........\$495 IBM AT or higher Marcon Plus ............\$795 IBM AT or higher AIRS (Automated Information Reference Systems), Inc. 335 Paint Branch Dr. College Park, MD 20742 (301) 454-2022 Inquiry 965.

### HYPERTEXT RESEARCH AND DEVELOPMENT

Bell Communications Research (Bellcore) 435 South St. Morristown, NJ 07962 (201) 829-2000 Superbook, a text browser Telesophy, on-line literary system

Thoth II, a system that embeds semantics into hypertext

Brown University
Institute of Research in
Information and Scholarship
P.O. Box 1946
Providence, RI 02912
(401) 863-2001
Intermedia, an interactive
teaching and learning environment
(in development)

Carnegie-Mellon University
Computer Science and English
Departments
Pittsburgh, PA 15213
(412) 268-2565
Notes, a hypertext writer's tool
(in development)
ZOG, a multiuser hypertext
system (in development)

MAD Intelligent Systems
55 Wheeler St.
Cambridge, MA 02138
(617) 492-1982
Developing hypertext through
machine-generated links.
Common Lisp software that runs
on a Mac II and Unix machines.
Prototype in use by the New
York Stock Exchange.

MCC (Microelectronics and Computer Technology Corp.) Software Technology Program 3500 West Balcones Center Dr. Austin, TX 78759 (512) 343-0978 gIBIS, a problem-analysis tool

**gIBIS**, a problem-analysis tool that runs on Sun workstations (in development)

PlaneText, a Unix-based, general-purpose system (in development)

University of Maryland
Department of Computer Science
Human Computer Interaction
Laboratory and Institute for
Advanced Computer Studies
College Park, MD 20742
(301) 454-4255
Hyperties, an instructional,

interactive encyclopedia system (in

development)

University of North Carolina at Chapel Hill
Department of Computer Science CB #3175
Sitterson Hall
Chapel Hill, NC 27599
(919) 962-1792
WE, an interactive writing environment

University of Southern California Computer Science Department Los Angeles, CA 90089 (213) 743-2311 DIF, a hypertext system with software engineering tools (in development)

The Xanadu Operating Co. 8480 Fredericksburg, Suite 138 San Antonio, TX 78229 (512) 927-6073 Xanadu, a worldwide hypertext library (in prototype for Sun workstations)

Xerox Palo Alto Research Center Intelligent Systems Laboratory 3333 Coyote Hill Rd. Palo Alto, CA 94304 (415) 494-4000 NoteCards, an information analyst's support tool

RECOMMENDED READING

Conklin, Jeff. "A Survey of Hypertext." *IEEE Computer*, September 1987.

Halasz, Frank. "Reflections on Notecards: Seven Issues for the Next Generation of Hypermedia Systems." *Communications of the ACM*, July 1988.

Hypermedia: The guide to interactive media production (premier issue from MIX Publications, 6400 Hollis St., #12, Emeryville, CA 94608, (415) 653-3307).

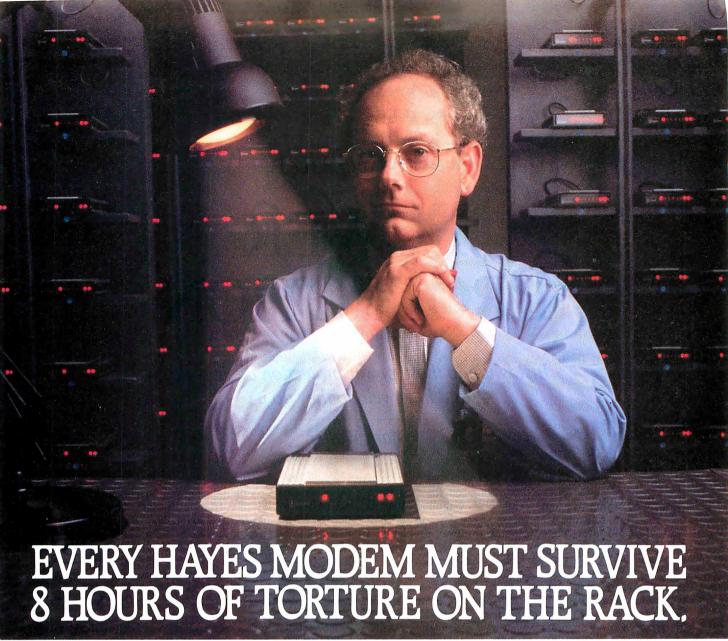
Hypertext '87 Conference Proceedings. University of North Carolina at Chapel Hill, Department of Computer Science (CB #3175, Sitterson Hall, Chapel Hill, NC 27599).

Nelson, Theodor H. "Managing Immense Storage." BYTE, January 1988.

Salton, G., and M. J. McGill. *Introduction to Modern Information Retrieval*. New York: McGraw-Hill, 1983.

### CONFERENCE

HyperExpo Boston World Trade Center Boston, Massachusetts October 15–16, 1988



The Rack. It's 8 straight hours of burn-in testing. Yet only one of many trials every Hayes modem must go through before it's packed and shipped.

In all, there are over 20 tests and inspections for quality and reliability. Thus allowing us to offer the most comprehensive performance warranty in the business.

Today, while all too many manufacturers are content to perform only the most perfunctory tests on their products and then only on a random

basis, we believe in testing all of our modems. With no exceptions.

At Hayes we've been making dial-up data communications as common and as reliable as ordinary phone calls for over a decade. Whether

PC-to-PC, PC-to-Host or PC-to-LAN, Hayes has set the standards.



And we intend to let nothing lower those standards. Especially one of our own modems.

For your nearest Hayes dealer, call **800-635-1225**. Hayes Microcomputer Products, Inc., P.O. Box 105203, Atlanta, GA 30348. © 1988 Hayes Microcomputer Products, Inc.

Hayes

PC Power, Part 1:

# **POWER PROTECTION**

Just what do those power protection devices do, and how well do they do it?

### Mark Waller



ention power protection, and the first thing many people think of is lightning. But, as someone who spends every day solving computer-related electrical-power problems, I think of money-protecting your investment in

computing without wasting your money in the process.

To be sure, you must protect your computers from lightning. But you don't want to spend hundreds of dollars on a product only to find that it won't solve your problem. Neither should you deceive yourself into thinking that by spending just a few dollars on a surge suppressor, you have absolutely protected your computer from being damaged by a thunderstorm.

### The Problem

Computer equipment is designed to operate with a steady stream of uninterrupted sine waves of 120 volts root means square (RMS). The nature of utility power is such that, as often as twice a day, you may experience some electrical disturbance that falls outside your computer's acceptable limits. In major data centers across the country, study after study has shown that surges, sags, brownouts, blackouts, and damaging impulses happen with dismaying frequency.

Over the last 10 years, the quality of power has steadily declined. Microcomputer users are especially vulnerable to this degradation. While mainframe computers have the advantage of employing a dedicated power source, microcomputers live off power straight from the local power company. However,

there is one alleviating factor in this situation.

Since you plug your computer into a nearby outlet, your machine is normally located a good distance from the building service entrance (i.e., the meter, or the place where power enters your building). Thus, in order to reach your equipment, potentially damaging impulses generated outside your location must travel through the impedance of lots of copper wire. This barrier serves to dampen out many of those disturbances, but you can derive only small comfort from this fact.

The real problem occurs along the electrical path from where

the power enters your building to your machine. Between these two points are all kinds of devices, such as elevators, air conditioners, coffee makers, and so on. The ignition of an oil furnace, for instance, produces an electrical spark that can generate an impulse that might be more than 1200 V. The starting transient of an air conditioner is strong enough to interfere with any electronic equipment that may be connected to the same power-source transformer. Copiers are notorious as a source of noise that creates soft errors in computers that share circuits with them.

Any equipment that arcs, cycles on and off, or draws excessive bursts of current is a potential hazard to your computer. There are far more pervasive culprits residing inside your building than any potential lightning strike, and they should be the prime focus of your protective strategy. Lightning-caused surges are rare events. When protective devices such as gas tubes (lightning arresters) are shorted across a power line, lightning is diverted to ground. When this happens, you and other users down the line will experience a momentary power sag. This is why you will see lights flicker during storms.

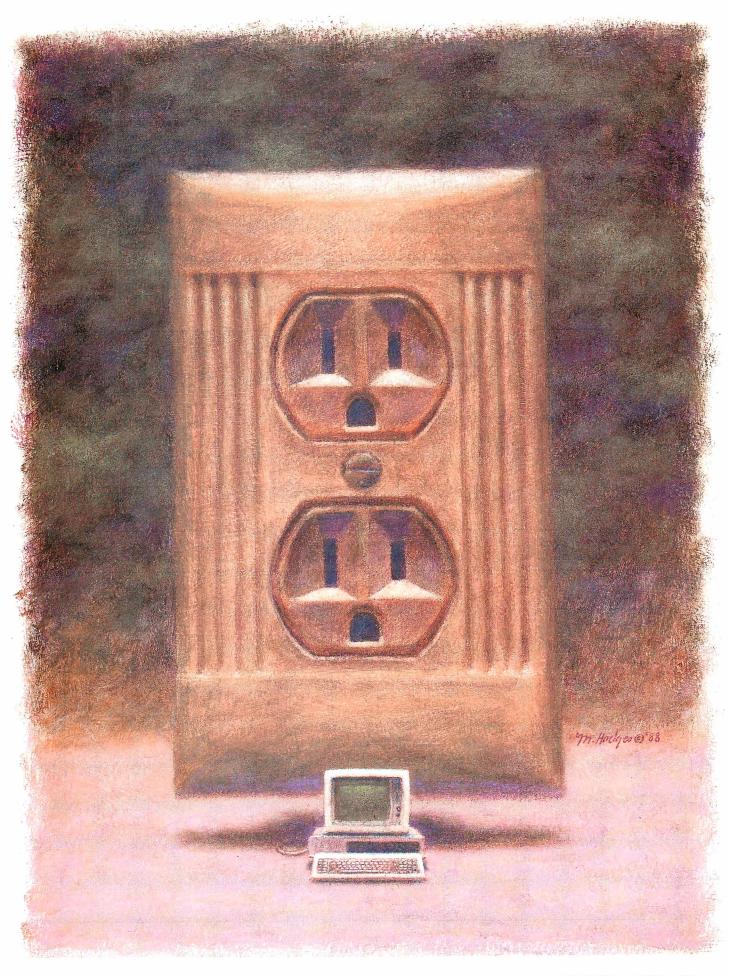
It's more important to protect your computer from the more common electrical malfunctions caused by equipment in your building than to protect it from infrequent lightning surges.

### Cause and Effect

The pressure to put computers into smaller and smaller packages caused a quiet revolution in power-supply design. Until the 1980s, computers used what is called a linear power supply (see figure 1). Its most prominent feature was a 60-Hz power transformer connected across the input (between line and neutral). After the line voltage was transformed from 120 V to 5 V, or whatever level was necessary to satisfy the DC logic, the power was rectified and filtered. (A rectifier is a device that converts AC current into DC current.)

Those 60-Hz transformers made linear power supplies big and heavy. Out of the need for smaller, lighter power supplies,

continued



the switching power supply was born (see figure 2). This design change eliminated the power transformer. With the new circuit, the incoming power is applied directly across the bridge rectifier. The resulting ripple DC is then pulsed at between 20 kHz and 100 kHz, depending on the specific supply design.

The action of chopping up the rectifier's output into high-frequency segments allows designers to use a high-frequency transformer, which is smaller and thereby reduces the size of the power supply.

The use of switching power supplies also dramatically affected computers' susceptibility to noise. A linear supply draws current in step with the voltage sine wave. In other words, as the line voltage rises and falls, the power supply's current demand rises and falls along with it. Linear power supplies are voltage-sensitive, however. If the supply voltage varies more than a few percent plus or minus, problems will develop.

On the other hand, a switching power supply (sometimes

called a switch-mode power supply) is not voltage-sensitive. Such power supplies draw current in huge gulps once every half cycle. For this reason, the power source's internal impedance can be a problem because if the impedance is too high, the power source cannot deliver power easily. But while you must be concerned about current, you do not have to concern yourself with voltage regulation as you do with the linear power supply. Switching power supplies regulate the level of voltage by varying the amount of current that is drawn. This action is basically independent of the voltage of the power source.

Because they contain switching power supplies, microcomputers can operate over a wide voltage range. This range can be from as low as 80 V to as high as 140 V.

There are devices on the market, such as ferroresonant transformers, that regulate voltage to microcomputers. However, since your computer's power supply does not need voltage reg-

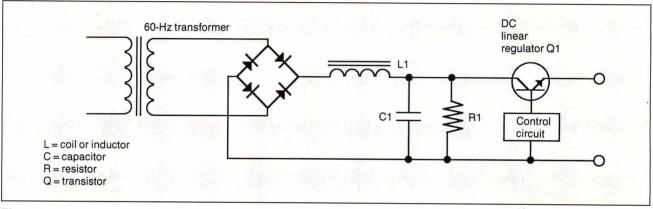


Figure 1: Linear power supplies, used in small computers up until a few years ago, featured a large 60-Hz power transformer connected across the input. Such power supplies were sensitive to variations in voltage and made power supplies bulky.

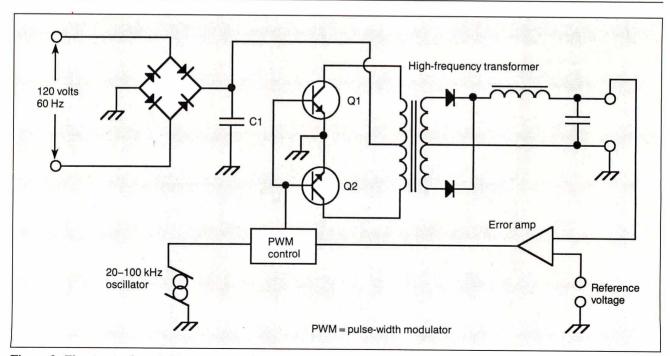


Figure 2: The circuit of a switching power supply. The use of small, high-frequency components allows such power supplies to be smaller but makes the computer vulnerable to common-mode noise.

Ten modules teach you how to write your own programs or modify existing software to fit your needs:

- · Getting Started in Programming & Software Design
- · Attacking the Problem
- How to Design the Solution and Arrange It Logically
- · Coding the Program: High Level Languages
- · Coding the Program: Assembly Language
- Testing and Debugging Made Easy
- · Creating Meaningful Documentation
- Modifying & Updating **Existing Programs**
- · Tools & Tricks for Program Design
- Writing Advanced Programs



### 15 Day Trial Examination Order Form

YES! I would like to learn how to make any computer do exactly what I want it to do and would like to examine the first module in the Series absolutely free. If I decide to keep it. I will pay just \$24.95 plus \$2,25 shipping and handling. I will then receive future modules automatically, one every 4 to 6 weeks. Each of

the 10 modules in the Series is \$24.95 plus \$2.25 shipping and handling and comes on the same 15-day Trial Examination basis. There is no minimum number of modules that I must buy and I may cancel at any time simply by notifying you.

If I do not choose to keep the first module, I will return all materials in good condition and pay nothing. Future modules will be canceled and I will be under no further obligation.

Available for IBM PC/IBM PC Compatibles (requires BASIC) and Commodore 64/128 <sup>TM</sup> microcomputers.		
Check your preference:	☐ IBM ☐ Commodore 64/128	
Name	(Please Print)	
Street		
City/State/ZIP		
Phone Number: ( )		

All orders subject to approval and payable in U.S. funds only. Available in U.S. and Canada only. Add stamp and mail today. 2500-108

CHEST READ CRESS SCHOOL

Post Office Will Not Deliver Without First Class Stamp



McGraw-Hill Continuing Education Center

3939 Wisconsin Avenue Washington, D.C. 20016-9265

Make Any Computer Do Exactly What You Want With McGraw-Hill's

Budget Plan

Declining Interest

# Contemporary Programming & Software Design Series Make no mistake. Almost all books an teach you only the final 5% of the total of the

From Writing Your Own Programs to Modifying Existing Software, Here's the New, Easy, and Low Cost Way to Unlock the Secrets of Your Computer

Whether you use computers for business, for personal applications, or for fun, off-the-shelf programs will never do everything you want them to do for you. That's because they were written by programmers to satisfy what they perceived as the needs of the greatest number of potential users—often missing some or many of your specific needs.

That's why McGraw-Hill's new Contemporary Programming and Software Design Series teaches you how to create your own software . . . either from scratch or by making key modifications to existing programs.

There is nothing magical about it. You learn the process of building a computer program step-by-step with McGraw-Hill Concept Modules sent to you one at a time, once a month. Each of the ten modules in the Series takes you through an important step in the development of the structure and detailed logic of a program, including testing, debugging, and documentation.

### Unique Interactive Hands-On Instruction

Each module includes an easy-to-understand guide PLUS a 5½" floppy disk containing typical programs and interactive instruction that you can run on IBM PCs, PC compatibles and Commodore 64 and 128 computers for hands-on experience.

In the first Module, for example, when your sample program (Declining Interest Loans) appears on your screen, you'll find errors on certain program lines. You'll also see that the program is only three-quarters completed.



Now comes the fun part, You'll discover how this program is built, and in the process you'll learn how to identify and correct errors, And by the end of Module 1, you'll actually have completed this program yourself.

But there's more, Special graphics on your screen work in conjunction with the accompanying guide to amplify, illustrate, and deepen your understanding of software design principles.

### The Crucial 95%—Learn the Foundation of Computer Programming

While the Series includes interactive disks that run on specific computers, everything you learn you can apply to any language or machine. Why is this possible? Because McGraw-Hill knows programming is far more than coding a program into the computer using a specific language. In the real world of computers, 95% of the programming process is carried out using design techniques that are independent of specific language or machine. It is this crucial 95% that you thoroughly understand and master in the Series.

Make no mistake. Almost all books and courses on "programming" teach you only the final 5% of the total programming process—namely, how to code in a specific language...information of little value if you don't know how to reach the point in the programming process when you are ready to code.

With the Series, however, you'll learn to create your own programs from scratch, even modify off-the-shelf programs. You'll learn enough BASIC and machine language to get you started on the remaining 5% of the programming process.

### Build Your Own Personal Software Library

The sample programs you work with throughout the Series are excellent learning tools. But they're more than that, By combining the sample programs onto one master disk, you'll have the start of your own personal software library. In addition to the programs you've written and modified throughout the Series, you'll also receive dozens of the most popular public domain and user-supported

programs, such as data base manager, word processor, calendar generator, appointments reminder and much, much more.

### 15-Day No-Risk Trial

To order your first module without risk, send the postage-paid card today. Examine the first module for 15 days and see how the Series will

help you make your computer do exactly what you want it to do!





If someone has beaten you to the card, write to us for ordering information about the Contemporary Programming and Software Design Series.



### McGraw-Hill Continuing Education Center

3939 Wisconsin Avenue Washington, DC 20016 ulation, these devices are unnecessary. In addition, such devices limit the amount of instantaneous current that can be delivered to your machine's power supply—an undesirable attribute, for the reasons explained earlier.

### Noise About Noise

If you look behind the faceplate of the nearest wall plug, you will see either two or three wires. The black wire is called the phase wire, sometimes termed the "line" or "hot wire." The white wire is called the neutral wire. If you see a third wire, it will be the ground wire and will be either green or bare copper. If you do not see a third wire, the installing electrician may have used the metal conduit as the ground path.

Where your service enters your building, you will find that the neutral and ground are bonded. If you measure the voltage between neutral and ground at the outlet, it will usually be zero. If you measure from line to ground, or from line to neutral, it will read 120 V. These three wires not only provide power to your computer, but are the path through which electrical noise travels.

Let's define electrical noise as any signal, other than the desired signal, that appears in a circuit. Noise, then, can be either minor or major. Noise can include large transient events or damaging impulses, or it can be continually oscillating signals from spinning motors and other kinds of interference. There are two kinds of noise; normal mode and common mode (see figure 3).

Normal-mode (or transverse-mode) noise appears as a voltage between line and neutral. The word normal is used because that's normally where utility power is transmitted, between line and neutral.

Common-mode noise can be measured from line to ground or neutral to ground. This type of noise appears on both the line and neutral with respect to ground; in other words, it is common to both lines.

Basically, your computer's power supply is vulnerable only to high-energy impulses that appear in the normal mode (normal-mode noise). And generally speaking, a computer's chips and logic are vulnerable only to common-mode noise.

Power-supply components are designed to take line voltage

(normal mode) with peaks of up to 170 V and convert it to DC. Because power-supply components are so rugged, they have a high degree of immunity to normal-mode noise. An oncoming impulse would have to be several hundred volts before it would damage your computer's power supply.

The old linear power supply, with its big power transformer, was immune to common-mode noise. Noise appearing along the line and neutral would cancel in the primary winding, because they are 180 degrees out of phase. If the cancellation process was imperfect, the magnetic transformation would convert it to normal-mode noise. Not so with switching power supplies.

Switching power supplies have no up-front transformer. And, because their components are tightly packed, they offer many capacitive paths at various frequencies. Stray capacitive coupling inside your machine and ground loops between other devices can let common-mode noise slip into, around, and through the power supply and reach the computer's chips and logic. Also, your logic chip's ground reference is usually tied directly to power ground—a sure recipe for disaster. What this means is that at various frequencies, common-mode noise may appear across the logic circuits themselves.

Because the distance between connections on the chip is only a few microns, ICs can tolerate only a fraction of the voltage that the rectifiers inside the power supply can tolerate. Noise from a few volts to a few dozen volts will interfere with your processing. Common-mode noise exceeding a few dozen volts could destroy your computer's chips.

### **Ground Yourself**

Ground, as it relates to computers, is probably the single most misunderstood electrical concept. As far as your computer is concerned, ground is not earth. Grounding something has nothing to do with driving a copper rod into your flower bed. The earth is not an electrical septic tank into which we flush unwanted noise to make it disappear forever.

Electricity travels in circuits, and current flowing to a point will flow away from that point. If current is directed to a ground wire, it will reemerge somewhere else along any electrical path that might be part of the ground circuit. This circuit may take different paths at different frequencies.

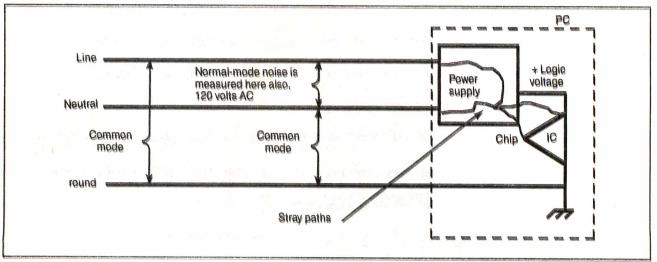


Figure 3: Normal-mode noise appears as voltage between the line and neutral wires in a circuit. Common-mode noise appears between the neutral and ground wires. If common-mode noise can find a stray path (and it will, especially through a switching power supply), it will appear across the chip from one of its pins and the logic ground pin. Normal-mode noise appears across the power supply just like utility power.

If a power glitch occurs in your computer at normal power frequencies, electricity directed to the ground wire should travel back to the electrical panel to trip a breaker. At higher frequencies, however, a noise signal may find stray paths through boards, cables, or between cabinets to be a far lower impedance route back to its source than the power ground wire. This is called a ground loop (see figure 4). Ground loops can be a source of processing errors as well as actual hardware damage.

Local area networks are extremely susceptible to ground loops. In such an environment, current will flow because of the electrical potential difference between the ground connections of different workstations. This undesirable current flow may induce dangerous voltage levels in nearby electronic components.

An IC is referenced to ground. It operates by detecting a logic level of so many volts with respect to ground. If the ground reference point changes in relation to the logic level, errors will result. If this voltage difference exceeds the withstand rating of the chip, current will bridge the substrate of your chips and destroy them.

**Suppressing Those Surges** 

Before looking at the actual circuit elements involved in the common surge suppressor, let's look at what it is supposed to suppress. Typically, you think of a surge as a spike or an impulse. Figure 5 shows what an impulse might look like. It initially rises to a peak and then oscillates in a diminishing fashion until it dissipates.

There are two vital features to an impulse. The first is its kinetic energy (joules or watt seconds) determined by its peak voltage, current, line impedance, and time span. The second is its rise time, or the time it takes to rise from nominal voltage to its peak voltage.

It is the front slope of the impulse that causes damage to your computer. This rapid rate of change is full of energy at various frequencies. The faster the rise time, the more high-frequency components the spike contains. It is these high frequencies that find those stray paths and cause all the damage. Lightning, arcing, and sparking have extremely fast rise times. At these high

frequencies, the physics of electricity and the paths it follows are very different from 60-Hz utility power. Your computer's circuitry was never designed to digest this kind of high-frequency energy.

Scientists have tried to quantify and define what the typical spike might look like. The result of their findings is a standard that has come to be known as the IEEE 587 ring wave (see figure 5). It is a waveform with strict parameters and is a test-measuring criterion for surge-suppression equipment. This is why so much good power equipment states proudly on its package that the product can withstand so many hits of the IEEE 587 test wave.

Recently, UL introduced a testing standard of its own, called UL 1499. In most respects, this waveform is similar to the ring wave. When you are in the market for surge-suppression products, look for these standards to tell you that the product actually performs as advertised.

But will surge suppressors really protect your computer?

### **Diversion Tactics**

Actually, a surge suppressor doesn't suppress unwanted electrical energy; it diverts it. Rather than suppressing, absorbing, arresting, or otherwise making unwanted impulses disappear, these devices actually divert the energy from one path to another.

Transient suppression devices come in four different varieties: metal oxide varistors (MOV), zener diodes, filters, and gas tubes. By far the most popular device is the MOV. The term varistor means variable resistor and describes the MOV's basic function. As voltage builds up across this device's terminals, it reaches what's called the breakdown voltage. At this point, the varistor changes from a highly resistive device to a low-resistance device, and large amounts of current can then flow through it.

If you connect a MOV in parallel to your machine, when a spike comes along, the MOV will clip it. In other words, that portion of the impulse that rises above the MOV's breakdown voltage is clipped off and diverted through the MOV. This clipping level is usually around 140 V RMS. The peak let-through

continued

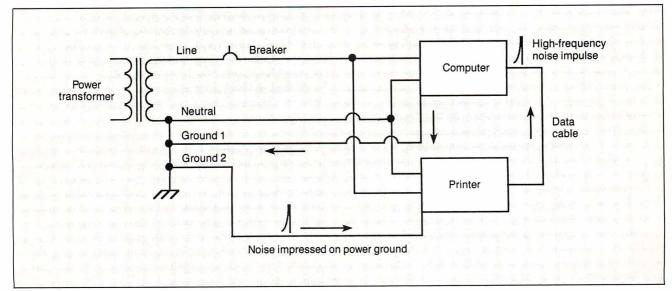


Figure 4: Noise current will take the path of least resistance, a situation that may interfere with the transmission of data between devices or even cause damage.

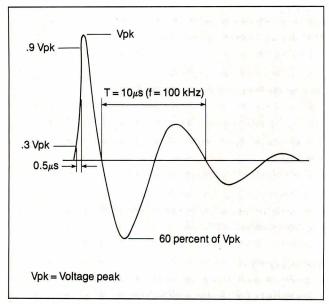
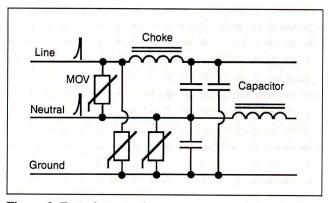


Figure 5: The IEEE 587 ring wave is a testing standard for surge-suppression products. Engineers have found this wave shape to be typical of what might appear on 120-V circuits leading to your computer.



**Figure 6:** Typical circuit of a surge suppressor. Most simple surge strips have only a MOV (metal oxide varistor) and capacitors from line to neutral.

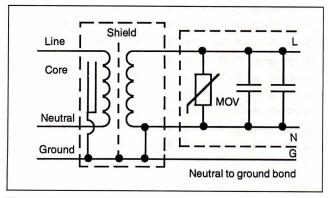


Figure 7: A power-line conditioner contains an isolation transformer with secondary surge suppression and the neutral and ground bonded.

voltage is likely to be as high as 340 V in some cases. Most often, you may think of a spike as appearing at the peak of the sine wave. But if the spike appears in the valley of the sine wave, the level of the voltage before clipping will be high. This is one of the weaknesses of this type of transient suppression device.

Zener diodes, sometimes called avalanche diodes, act similarly to MOVs. They do, however, have different performance characteristics. Zeners have a faster response time and come in sizes with a lower breakdown voltage than MOVs. MOVs, however, can usually handle more current than zeners. In order to take advantage of these complementary qualities, manufacturers often place both devices in surge suppressors.

Filters, in the form of capacitors and chokes (coils), are used in surge products to block the flow of noise current at the design frequency and to divert it through a lower-impedance path. Most surge suppressors have one or more capacitors. The better ones have chokes in series on the line and neutral wires.

Another device common to some suppression products is the gas tube. When voltage builds up across a gas tube's terminals, the gas inside the tube ionizes and becomes a conductive path. Through arcing, the path ionizes, and the energy is bypassed.

The arcing action of a gas tube, though, creates very undesirable high-frequency characteristics that make it inappropriate for placement near your computer. In addition, a gas tube can take a seemingly unimportant impulse and turn it into a damaging impulse. Yet, the market has seen the proliferation of tiny gas tubes inside surge suppressors. Evidently, designers think that including a gas tube in a surge suppressor will give you the illusion that it can handle enormous amounts of energy.

The proper use for a gas tube is in a lightning arrester placed near your building's service transformer. Enough wire exists between this point and your machine to block the passage of the high-frequency effects of gas-tube firing.

In figure 6, which shows a typical surge-suppressor circuit, notice the MOV that is placed between line and neutral. As this MOV conducts a high-energy impulse from the normal mode, current is dumped onto the neutral. This current flow creates a voltage drop between neutral and ground. By this process, the surge device has used normal-mode noise to generate common-mode noise. Photo 1 shows that the impulse created by this current flow is nearly as large as the one from line to neutral.

Notice that to protect your computer from common-mode noise, figure 6 also shows MOVs connected from line to ground and from neutral to ground. This is a good feature. But remember that common-mode noise sensitivity is significantly higher than that for normal mode. You must be concerned with the logic and any voltage that might appear across it. A MOV will allow up to several hundred volts to pass through before it activates.

### **Suppressor Circuit Caveats**

In the surge-suppressor circuit (see figure 6) you see filtering elements made up of chokes and capacitors. This is a fairly well-engineered circuit. Someone has taken the time to worry about both normal- and common-mode noise and has included filtering as well. Unfortunately, simple surge strips that go for about \$10 to \$20 usually have only one MOV between line and neutral. Obviously, you should be concerned about what's inside the surge suppressor, though it is difficult (if not impossible) to tear open a product before you buy it.

There is still another problem. Not only does the common surge protector convert one kind of noise into the kind your computer finds least tolerable, but when parts of your device

continued



# Data Sentry

# Protects Your PS/2 and PC Data

The DataSentry from Rainbow Technologies offers a cost-effective means of protecting files on any IBM PS/2, PC/XT/AT, or compatible. The DataSentry is a compact, user-installable, external hardware security system utilizing DES methodology. It is the only protection system of its type that is fully compatible with all models of the IBM PS/2 system.

### **Applications**

- IBM PC/XT/AT and compatibles
- IBM PS/2 all models
- · Laptop computers

### **Benefits**

- Secured modem transmissions
- File privacy on shared computers
- Department-wide data security

### **Features**

- Simple to use and completely user-installable
- Can protect individual files or whole directories
- Encrypts files using DES or a fast proprietary algorithm
- Compresses encrypted files to save disk space
- Provides master keys for multi-level security systems
- Optional password protection

The DataSentry System. The Key to Safe Files.

### **O** RAINBOW TECHNOLOGIES

18011-A MITCHELL SOUTH (714) 261-0228 TELEX: 386078

IRVINE, CA 92714 USA FAX: (714) 261-0260

 1988 Rainbow Technologies, Inc. DataSentry is a trademark of Rainbow Technologies. IBM is a registered trademark of International Business Machines.

	1985	1986	1987	1988
Jan.	\$4.00			\$6.00
Feb.	\$4.00	\$6.00	\$6.00	
March	\$4.00		\$6.00	\$6.00
April	\$4.00		\$6.00	
May	\$4.00		\$6.00	\$6.00
June	\$4.00	\$6.00	\$6.00	\$6.00
July		\$6.00	\$6.00	\$6.00
Aug.	\$4.00	\$6.00	\$6.00	\$6.00
Sept.	\$4.00	\$6.00	\$6.00	\$6.00
Oct.	\$4.00			
Nov.	\$4.00			
Dec.	\$4.00	\$6.00		

### BACK ISSUES FOR SALE

SPECIAL ISSUES and INDEX			
BYTE 1985 INDEX	\$2.50		
BYTE 1986 INDEX	\$2.00		
BYTE 1987 INDEX	\$2.50		
1985 INSIDE THE IBM PCs	\$4.75		
1986 INSIDE THE IBM PCs	\$5.00		
APPLICATIONS SOFTWARE TODAY SPECIAL	\$4.00		

Circle and send requests with payments to:

BYTE Back Issues One Phoenix Mill Lane Peterborough, NH 03458 (603) 924-9281

		(003/ )2: >2		
☐ Check enclos	Check enclosed Payments from foreign countries must be made in US funds payable at a US bank.			
$\square$ VISA $\square$	MasterCard			
Card #		Exp. Date		
Signature		2 2 2 2		
The above prices inc	ude postage in the US. Please add \$ .50 per copy fo allow 4 weeks for domestic delivery and 12 weeks f	or Canada and Mexico; and \$2.00 per foreign delivery.	copy to foreign countries (sur-	
European customers	please refer to Back Issue order form in Internation	al Advertising section of book.		
Name				
Address			2000	
CITY		State	Zip	

# HOW DO YOU GET A JOB WITHOUT EXPERIENCE? AND HOW DO YOU GET EXPERIENCE WITHOUT A JOB?

Most young people have one answer to this problem. They avoid it until they're out of college. But they could be getting solid work experience while they're still in college. With your company's help. And ours.

We're Co-op Education. A nationwide program that helps college students get real jobs for real pay, while they're getting an education.

But we can't do it without you. Those real jobs have to come from real companies. Like yours.

For more information on how you can participate in this valuable program, write Co-op Education, Box 775E, Boston, MA 02115.

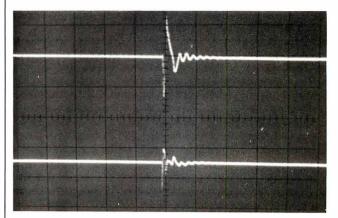
Not only will you be giving students a chance to earn money and pick up the most valuable kind of knowledge, you'll be giving yourselves a chance to pick up the most valuable kind of employee.

# **Co-op Education.**

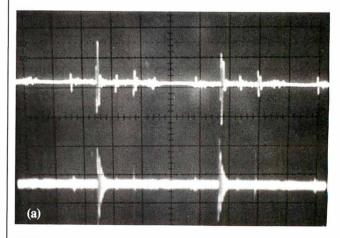
You earn a future when you earn a degree.

fail, the device won't give you any indication that you no longer have surge protection. Because they are connected in parallel to your computer, when MOVs or zener diodes fail, your machine will still run and you won't know that the surge device has passed away.

Perhaps to make you feel better, some manufacturers build continued



**Photo 1:** As the impulse in the normal mode (top trace) is conducted by the MOV from line to neutral, another impulse (bottom trace) appears between neutral and ground, the common mode.



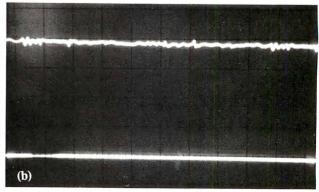
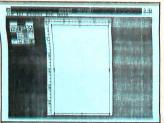


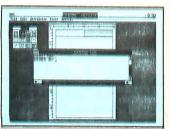
Photo 2: These photos show noise in an electrical circuit, (a) before and (b) after insertion of a power-line conditioner. In both photos, the top trace is normal-mode noise and the bottom trace is common-mode noise.



1. Start with clean page at 1:10 p.m.



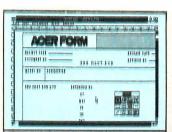
Type and place sub heading.



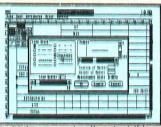
2. Type in text through Edit window.



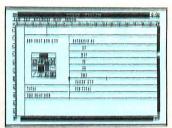
6. Use tool 7 to add multiple lines.



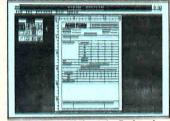
3. Load image and add lines.



7. Make connecting lines invisible.



4. Add lines to form table.



The finished form in Reduced View at 1:24:32 p.m.

# Create a professional form in less than 15 minutes!!!

CERFORM is an MS-Windows application. All the advantages you enjoy and rely on from Windows, like excellent graphics, are at your fingertips when you use ACERFORM. With ACERFORM, lines can be as thin as a strand of hair or as thick as your pencil. For frame and text backgrounds you have 16 patterns to choose from.

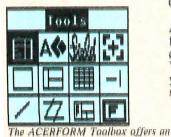
Corporate logos and other images are easily loaded and sized. With SoftFont, character styles come in a wide variety of shapes and sizes -- and the fonts you select are shown right on the screen, just as they appear on your printed form.

Selectable line widths range from 0.5 cm to .01 cm.

# Actual loaded image.

Landed, resized image.

ACERFORM offers a comprehensive toolbox with 12 tools to aid you in drawing lines, loading and cropping images, and typing or loading text. There's also a tool especially for block operations, such as saving a part of your form for loading into another form or uniformly editing parts of your form.



ACERFORM's text editing feature allows you to utilize data from several sources. You can key in directly from your keyboard or load data stored in WordStar,

dBase III Plus and Lotus 1-2-3,

unprecedented range of form tools.
MS-Windows is a registered trademark of Microsoft.
MS-Windows is a registered trademark of Microsoft.
MSM, TC-XYFAT and TS-2 are registered trademarks of International Business Machines Corp.
MordStar is a registered trademark of MicroPro. Inc. dBase III Plus is a registered trademark
of Astron-Tate, Inc. Latus and 1-3-3 are registered trademarks of the Latus Development Corp.
ACER is a registered trademark of Acer Incorporated.

This advertisement was created using ACERFORM.

CERFORM enables both mouse and keyboard users to develop a form efficiently without dealing with complicated screens and strange codes. The command menus and form tools complement one another to make form building a logical and simple process.

ACERFORM supports most laser printers and is for use on IBM PC/XT/AT/386 & PS/2 compatible systems. Write us today for more details.

### USING ACERFORM YOU CAN:

- Merge data from external sources as you print.
- Easily draw lines and frames and place them on your form accurately.
- Load, place, crop and size images accurately.
- See the actual form and all font typefaces and sizes on your screen as you work.
- Fill out the form completely, partially, or not at all.
- Make this advertisement. (We did!)

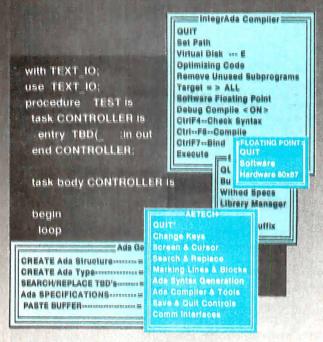


Publishing hird Corp Dept. J. 977 Min Sheng East Road, Taipei 10581, Taiwan, R.O.C. TEL:886-02-763-0052 TLX: 29335 THIRDWVE FAX:886-02-765-8767

### PC POWER PROTECTION



the first completely integrated Ada Programming Support Environment priced for the individual programmer on a PC. Designed for the novice as well as the software engineer



- Validated Production Compiler
- Use on 8086,80186,80286,80386.
- Full 640KB .EXE Programs
- No Extra Memory Required
- No Math Coprocessor required.
- On-Line Library Management
- Math, Text, Console Packages included
- Multiple File Code Retrieval
- Full-Color, Full Featured Editing
- Selectable Function Keys
- Ada Subprogram and Package Generation
- Ada Type Generation
- Ada Sensitive Cursor
- Interactive Cursor Error Correction
- Interface to Ada Design Language (ADADL)
- Ada Standard Pretty Printer
- DoD 2167 Documentation Features
- Optional On-Line Ada Training Course
- No Run-Time Royalties

AETECH 380 Stevens Ave, Suite 314, Solana Beach CA.92075

(619) 755-1277 FAX (619) 755-7540

"...the first choice among the half dozen or so compilers now on the market"— PCWEEK

NETECH

Introductory Offer \$495

into surge protectors a status indicator—usually a little green light. A green light tells you everything is OK, right? Wrong. Most status indicators just tell you that power is flowing. Thus, you may think your surge strip is protecting you, but you don't know for sure.

So, is a surge suppressor the answer to protecting your equipment? Not really. There is an alternative that will protect your computer investment much better than a surge suppressor.

### A Better Solution

If you want to protect your investment in computing without wasting money on products of dubious utility, or if you are trying to solve power problems you already have, I recommend a power-line conditioner with a built-in isolation transformer at its heart (see figure 7). Properly designed, the transformer, along with a couple of capacitors and a MOV across the secondary, will give you security far superior to that of a surge protector. Photos 2a and 2b (before and after insertion of a power-line conditioner) show how effective this design can be in protecting your computer from undesirable voltage impulses.

The isolation transformer acts as an inductive cushion, stripping away high-frequency components of normal-mode noise. Any remaining normal-mode noise will be shunted by the filter capacitors connected across the transformer's secondary, or by

the MOV if it contains high energy.

Perhaps a power-line conditioner's most important feature is the neutral-to-ground bonding on the secondary side of the transformer. This is a requirement of the national electrical code that has some very happy consequences for all microcomputer users. This bonding is a short circuit for common-mode noise, and, since there is no impedance across a short circuit to allow a voltage to develop, common-mode voltages do not occur (Ohm's law: current × impedance = voltage). With this type of device, no voltage will appear across your logic circuits.

### Suppress or Condition?

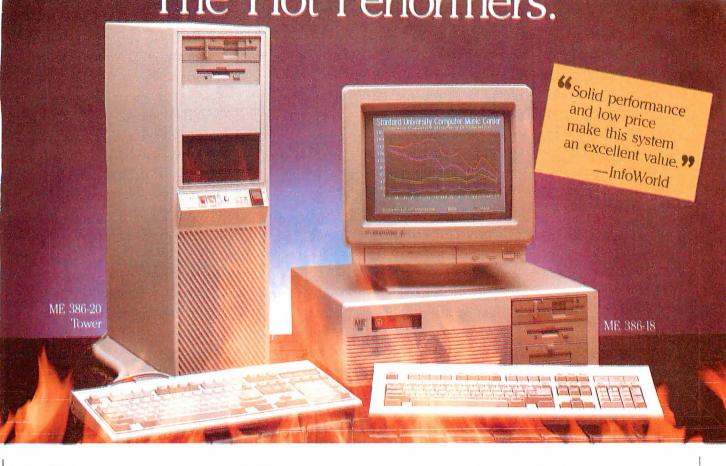
When all's said and done, then, what kind of device will really power-protect your computer? If you opt for a surge suppressor, a device that is relatively inexpensive and easily available, what features should you make sure it has? You want filtering as well as surge suppression. You have to have both normal- and common-mode protection. And you should have some way of determining the state of the device's internal components. In addition, be sure that it has been tested to UL 1499 or IEEE 587 standards. To obtain this type of surge suppressor, you will probably have to pay more than \$100. But even if you do choose this route, you have hardly obtained the ultimate in power protection for your computer.

If you opt for the alternative, a power-line conditioner, you may need to ask the advice of a power professional to help you make the best choice, or you can purchase your device from an industrial or commercial dealer. This more effective product costs around \$250, much more than a simple surge strip.

Computer power protection is not as easy or Inexpensive as you might think. Protective devices are like insurance—a trade-off between cost and risk. In most cases, a quality choice, while it may not be the least expensive, is the best choice.

Editor's note: Next month, in Part 2 of this series, Mr, Waller will discuss backup power devices,

Mark Waller is a computer facilities consultant and the author of Computer Electrical Power Requirements and Mastering PC Electrical Power, both published by Howard W. Sams. He can be reached on BIX as "editors."



### ME 386-20

20 MHz 80386-20 processor Microsoft OS/2 and DOS compatible 1 1 MB 32-bit RAM running at "0" wait state (upgradable to 8 MB) Socket for 80387/80287 math co-processor | High performance NCL floppy/hard disk controller 1.2 MB floppy disk drive CMOS clock/calendar with battery back-up I Enhanced

keyboard Upright Case Add \$300

### ME 386-18

18 MHz 80386 processor Microsoft OS/2 and DOS compatible 512K 32-bit memory on board Two 32-bit expansion slots Socket for 80387 math coprocessor | High-performance NCL floppy/hard disk controller 1 1.2 MB floppy disk drive | CMOS clock/calendar ☐ Enhanced AT keyboard

### ★ SPECIAL >

ME V20 | 64K Gupginon ble to □ 360K (Norv. disk drive □ Monochrome graphics card □ Monochrome monitor Keyboard Complete system...\$499.00

### ME Roadrunner

12 MHz 80286 processor - Socket for 80287 math co-processor 1 640K memory (1 MB option) | New Super-Twist LCD with Backlit and Reverse; 640 x 200 dots (640 x 400 option); 80 char. x 25 lines

| Monochrome/Color graphics card for external monitor 

6 expansion slots

Floppy/hard disk controller - Serial/parallel/clock-calendar | 1.2 MB floppy disk drive 20 MB hard disk (30, 40, or 60 MB optional) - 12-function AT style keyboard 110/220V auto-switchable 20 pounds

### Roadrunner Plus (386)

Intel 80387 processor 116/16 MHz clock speed 1 1 MB of memory 1 Socket for math co-processor | Floppy/hard disk controller 1.2 MB high capacity floppy disk drive - 42 MB fast access hard disk (60 MB optional) ☐ Serial/parallel ports Color/mono display card for external monitor New Super-Twist LCD with Backlit and Reverse; 640 x 400 dots; 80 characters x 25 lines 🗆 6 expansion slots □ 12-function keyboard □ 110/220V auto-switchable | 20 pounds

Circle 165 on Reader Service Card (DEALERS: 166)

### ME 286-12

8/12 MHz 80286 processor | 512K memory (upgradable to 1 MB on board) "0" wait state option (s.i. 15.3) | Microsoft OS/2 and DOS compatible | 81/O expansion slots | High-performance NCL floppy/hard disk controller 1.2 MB floppy disk drive III CMOS clock/calendar Enhanced keyboard

### The Network Solution

ELS Network for two-to-four users. Increase your company's productivity without making a big increase in expenditures. Complete software... \$

Call for all Novell Products

Prices and availability subject to change without notice





CALL TOLL FREE



2114 South Grand Avenue Santa Ana, California 92705 Fax: (714) 662-1258 - Telex: 910 240 3029

Come See Us At COMDEX Booth #C607

# Discover Parallel Processing!

### Monoputer"

The Most Cost Effective Transputer Development System

MicroWay's Monoputer is the best selling Transputer-based PG coprocessor in the world. It was the first board available to run the 20 MHz T414 or T800. As a result, it received many rave reviews in the UK (available on request) and became the standard Transputer software development tool. Parallel code can be executed on a single Monoputer or on an array of Monoputers wired together by their external link lines. The Monoputer includes 2 megabytes of 100 nises DRAM, a 20 MHz T414 or T800 and the MicroWay stand alone Oceam. Compiler, which generates Transputer code that runs under MS-DOS. Optional tools include our licensed version of the TDS and a Pascal, Fortran, C, and Prolog.

### Quadputer

Mainframe Power For Your PC!

MicroWay's Quadputer is the most versatile multiple Transputer co-processor on the market today. It can be purchased with 2, 3, or 4 Transputers, each of which has 1 or 4 megabytes of local memory. Two or more Quadputers can be easily cabled together to build larger parallel processor systems. A single Quadputer using four T800s provides 40 MIPS of CPU and 6 megatlops of NDP throughput at one fiftieth the cost of a comparably performing mainframe.

sometimes of the state of the s

For more information please call (617) 746-7341. After July, 1988, call (508) 746-7341.



### The World Leader in PC Numerics

P.O. Bex 79, Kingsten, Mass. 02364 USA (617) 746-7341 32 High St., Kingsten-Upen-Thames; UK 01-541-5466 St. Leenards, NSW, Australia 02-439-8400

TRADEMARKS Guadpoler, Alputer and Menopoler of MicroWay Inc. IMMOS, transpoler, TDS, OCCAM of IMMOS Corp. MicroWay is a registered trademark of MicroWay, Inc.

### Part 1

# A SUPERCOMPUTER

Steve begins a supercomputer project by looking at multiprocessing basics

very month, I get several hundred letters from readers. Many of them ask for help with specific hardware or software problems, but there are always a few letters chiding me for not building a real computer. They imply that even 80386 and 68030 machines are simply uninteresting, and that I should design a supercomputer of one sort or another.

Unfortunately, the problem with a supercomputer is that it takes super software to drive it. Remember, my favorite programming language is solder, and that doesn't make me particularly fond of introducing "Yet Another Computer System" with "Yet Another Program-ming Language."

But around the Circuit Cellar we like to do things that are out of the ordinary. I thus decided to see what it would take to build a supercomputer, and I thought you would be interested in how I determined the proper architecture. The result is a three-part description of multiprocessing that starts with theory and ends with reality.

The Circuit Cellar supercomputer is a multiprocessor computer specialized to evaluate the iterative formula describing the Mandelbrot set, so a more accurate name is the Circuit Cellar Mandelbrot engine. A driver program running on an IBM PC AT presents the results in realtime color on an EGA or a VGA, with smooth panning and scrolling so you can examine the results on the fly. System performance increases as you install more processors. You can start with a single processor, graduate to 64 processors (as in my example), or work up to a

monster system with 256 processors.

The Circuit Cellar Mandelbrot engine starts at roughly twice the performance of an 8-MHz AT with just one card of 8 processors, increases smoothly past a 16-MHz 80386 with three cards (24 processors), and zooms far beyond it with 64 processors (eight cards). I haven't found anything (under \$500,000) to compare with a full-bore system of 32 cards. Not bad, considering that the Mandelbrot engine is based on the lowly Intel 8051.

In this first part, I'll describe how to increase the performance of single-processor systems and show why there's a definite upper limit to processing speed. The solution seems to be using multiple computers on the same problem, so I'll explore some of the different ways to connect multiple processors in arrays, and the troubles that arise from these connections.

Before launching into a discussion of multiprocessing, I'll review some of the performance problems and solutions for single-processor systems. I'll start with the simplest possible system and work up to pipelining and caching.

### **Building Performance**

In comparing performance, you must be careful what you're measuring. A convenient unit is the number of instructions per second, which you get by dividing the total number of instructions executed by the elapsed time from start to finish. A processor that executes twice as many instructions in a given time has twice the performance, for an increase of 100 percent. (Some of the examples I'll give will focus on the number of cycles per instruction, which is the reciprocal of the number of instructions per cycle. Be careful not to compute the performance ratio upside down.)

Figure 1 shows the two essential components of a computer: a CPU and memory to hold the program and data. The fat arrow between the two represents the address, data, and control lines running between them. For these discussions, I'll ignore the necessary I/O hardware and presume that the program and data are already loaded into memory.

This CPU is so simple that it doesn't include any registers; all operations must refer to memory locations. For example, an ADD instruction must specify three memory locations: one each for the two numbers to be added and where to put the result. Although your favorite microcomputer may not have such an ADD instruction, the earliest computers (back in the Good Old Days of relays and vacuum tubes) actually worked this way. Figure 2 shows the execution sequence for the ADD instruction I've described. Each vertical line marks a single CPU clock cycle or memory access.

The first step, of course, is to fetch the ADD instruction from memory. After the instruction arrives in the CPU, it is decoded to determine the addresses of the operands. The CPU then fetches the operands and performs the addition. Finally, the CPU stores the result back into memory. This sequence repeats for each instruction, with some variation.

What's of interest is that a single instruction requires four memory accesses: an instruction fetch, two data fetches, and one data store. During two more cycles, memory is idle while the CPU decodes and executes the instruction. Other instructions have different sequences, but the overall pattern is

The memory in this example must be able to return data within a single CPU cycle and also be ready for another access at the start of the next cycle. Dynamic RAMs need some time after an access to get ready for the next operation; the minimum time between accesses is the DRAM's cycle time. The memory's cycle time is necessarily longer than the access time required to return data. Typically, DRAMs have a cycle time that's about twice the access time.

continued

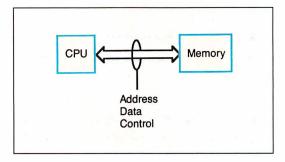
For example, premium DRAMs with a 100-nanosecond access time have a cycle time of about 200 ns, so each CPU cycle must be 200 ns. The ADD instruction I've presented will therefore take 6 × 200 ns, or 1200 ns. Some instructions

may be faster and some slower, so the CPU will run at about 800,000 instructions per second.

Increasing the performance of this machine by a factor of 2 sounds simple enough: Double the clock frequency and

reduce the CPU and memory cycle times to 100 ns. Unfortunately, DRAMs with a 50-ns access time and a 100-ns cycle time are on the forefront of technology right now, and more expensive than you can imagine. But all is not lost.

**Figure 1:** The essential parts of a computer system.



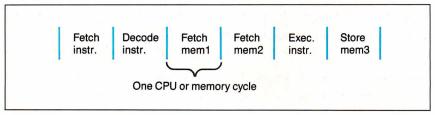
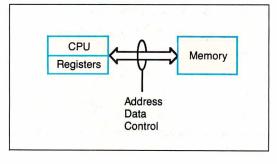


Figure 2: Execution sequence for the instruction ADD mem1, mem2, mem3.

Figure 3: Adding registers to the CPU of figure 1.



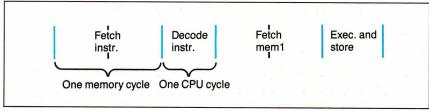


Figure 4: Execution sequence for ADD mem1, reg. Note that memory access is now two CPU cycles (see text).

### **Registered Speedup**

Figure 3 shows a more complex CPU with internal data registers. Each register can hold the same amount of data as one memory location, so an instruction can refer to either memory or registers. Because the registers are on the CPU chip, register accesses are faster than memory accesses. To take advantage of this, the definition of an ADD instruction changes so that it now adds the contents of a memory location to an internal register and puts the result back into the same register. This reduces the number of memory accesses to two: one instruction fetch and one data fetch.

The reason for these changes is to let the CPU run with a faster clock rate than the memory could otherwise tolerate. The CPU cycle time can now be 100 ns, half the memory cycle time of 200 ns. Any memory access must include one extra cycle, but operations within the CPU can now proceed twice as fast as before.

Figure 4 shows the execution of the new ADD instruction. Fetching the instruction takes two clock cycles because of the memory access, but decoding it takes only one. Fetching the operand from memory takes two more cycles, but the result is computed and stored in a register in a single cycle. The ADD instruction takes six cycles from start to finish, but the faster CPU clock rate reduces the total elapsed time to only  $6 \times 100$  ns, or 600 ns, half that of the processor in figure 1.

Both processors use the same type of memory, but the second system has twice the performance of the first. Bearing in mind that a typical system has only one CPU and several megabytes of memory, a more complex CPU is a good way to improve the overall system performance without increasing the overall cost beyond reason.

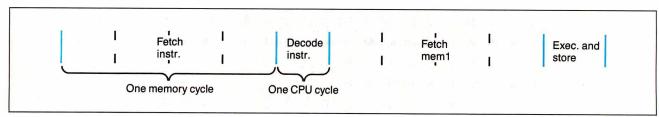


Figure 5: Doubling the CPU clock speed for the instruction shown in figure 4 yields this sequence. Since the CPU is running twice as fast, memory access now requires four cycles.

The extra cycle for each memory access is commonly called a wait state. Many of the newer AT clones run with zero-wait-state memory, which simply means that the memory can keep up with the processor. The complete details are a little more complicated than I've shown here, because the AT's memory is actually measured by access time rather than cycle time, but the principle is similar.

If doubling the CPU clock rate helped so much, how about doubling it again? Memory accesses now require 4 cycles (4  $\times$  50 ns, or 200 ns), and figure 5 shows what happens. The ADD instruction now takes 10 cycles, for an elapsed time of 10 × 50 ns, or 500 ns. Doubling the clock rate improves performance by only about 20 percent because the CPU now spends most of its time waiting for memory accesses.

But if 100-ns-cycle-time memory was too expensive, you can imagine what 50ns memory will cost. At some point, the system will outrun the fastest DRAMs, so static RAMs are the only choice. SRAMs have about 25 percent the density of DRAMs, so the chip area that can hold a 1-megabyte DRAM will hold only 256K bytes of SRAM. Prices are driven by chip area, so the memory cost increases by a factor of 4, even without considering the additional cost of the faster memory.

### Access Caching

There's another trick we can use: memory-access caching.

Although the system may have megabytes of memory, most program instructions are clustered in small groups. For example, a loop may execute a dozen instructions hundreds of times. Data accesses can be clustered in the same way, as with a word processor updating successive characters in a buffer.

A cache takes advantage of this typical program behavior by storing the most recently accessed instructions and data in a local memory that's much faster than the main memory. Figure 6 shows a cache inserted between the CPU and the memory unit. Instructions and data in this

cache can be returned in one cycle, just like the CPU registers. But if there's a cache miss and the cache must access the main memory, the access will take five CPU cycles.

Assuming that the CPU is running at 50 ns, figure 7a shows that an ADD instruction with all cache hits takes only 4  $\times$  50 ns, or 200 ns. If those hits turn into misses, the ADD instruction takes 12 × 50 ns, or 600 ns (see figure 7b). It's obvious that the cache hit ratio determines the overall system performance.

More complex caches guess where the processor will need data and prefetch from those locations so that the CPU's accesses will be hits. Some systems have separate instruction and data caches with different updating strategies to take advantage of the differences in access patterns. In fact, a cache is one of the trickiest parts of a system, and it can harbor the most obscure bugs for the longest times.

### The Last Drop: Pipelining

We can squeeze more performance from the processor by introducing instruction pipelining. Pipelining, also known as overlapped execution, takes advantage of the fact that each instruction breaks down into several distinct phases. The ADD instruction I've been using has four phases, which I'll call I-fetch, I-decode, D-fetch, and D-store. By adding CPU hardware to handle each phase separately, we arrive at figure 8.

Figure 9 shows the sequence of events as the CPU begins executing a series of ADD instructions, each with different memory and register operands. A new ADD instruction starts every clock cycle, so, after the pipeline fills, the throughput is one ADD instruction every clock cycle. Although an ADD instruction (with cache hits) still takes four cycles, one ADD instruction finishes every cycle, so the overall performance is 50 ns per ADD instruction.

In this example, the pipeline hardware improved performance by a factor of 4 at the same clock rate. As with the other tricks, pipelining doesn't always provide that much improvement. For example, if an instruction needs a register set by a previous ADD instruction, the CPU must ensure that the instructions complete in the right order.

Not all instructions have the same number of phases, so the pipeline may not always be full. Branch instructions are a particular problem, because the system can't determine the next instruc-

continued

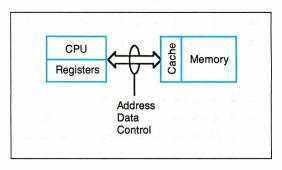


Figure 6: The modified system from figure 3 is further modified by adding a cache between the CPU and memory.

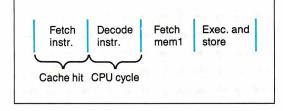


Figure 7a: Executing the instruction ADD mem1, reg on the cached system, assuming one-cycle cache hits.

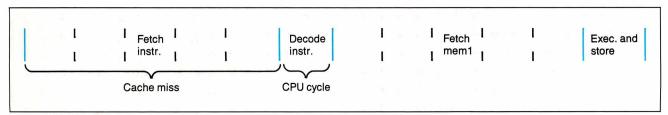


Figure 7b: Executing the same instruction as in figure 7a with five-cycle cache misses.

tion address until after the branch is decoded. As with caches, pipelines require some very subtle logic to take account of all the possible combinations.

It's worthwhile to remember that these tricks do not always improve the processor's performance. For example, if a program doesn't use a small set of data that fits into the cache, every data reference will be a cache miss. Similarly, if the program has many branches that flush the pipeline, the throughput will drop off to the level of a processor that hasn't been pipelined. No matter what the hardware assumes, someone can always write a program to bring the system to its knees.

### **Performance Limits**

From these examples, you can see that the ultimate limit to a processor's performance is one instruction per clock cycle. Although several instructions may be in the pipeline, each clock cycle will produce only one result at a time. That's the upper, theoretical, ideal limit, so cache misses and pipeline flushes can only detract from it.

Because a single processor can produce only one result in a clock cycle, the only way to boost performance (for a given processor design) is to increase the clock frequency. This explains the "clock race" pushing 80386 machines

beyond 20 MHz. Unfortunately, performance increases by the same factor as the clock rate. Therefore, a 24-MHz 80286 is, at best, three times faster than an 8-MHz 80286.

What the block diagrams do not show is the incredible amount of hardware required to add caches, pipelining, and all the other sorcery to support the higher clock rates. All this circuitry must run at the increased speed, and designers find out that tricks that worked well at lower speeds aren't as effective at higher speeds.

Regardless of your cleverness, the hardware circuit technology will set an upper limit to the clock rate. Mainframe computers, with custom LSI chips and optimized interconnections, run at about 60 MHz. In round numbers, 30 MHz is the fastest clock rate you'll see on your desktop computer for quite a while, because the price of the technology goes up dramatically beyond that point.

A 30-MHz clock rate means that a processor can produce one result every 33 ns at best. If the program and hardware can support one instruction per clock cycle, the processor will hit 33 million instructions per second. In real life, of course, your mileage may vary....

To put this into perspective, a standard 4.77-MHz IBM PC runs at about 0.1 MIPS. A stock 8-MHz AT runs at

about 0.5 MIPS, and a 20-MHz PS/2 Model 80 does about 3 MIPS. The best we can expect in the near future is only another order of magnitude faster.

Obviously, something has to give if we want still more performance from a computer system.

### **Architectural Choices**

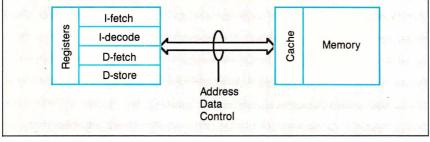
If one processor can deliver one answer in one clock cycle, how many answers will two processors deliver in the same time? Although this sounds like a child's riddle, the answer is profound: two!

The work needed to solve some problems can be divided more or less equally among multiple processors. If each processor can run simultaneously, the total performance increases directly with the number of processors. Two processors will produce the result in half the time of a single processor, and so on.

There are several different types of multiprocessor systems, each suited for a different class of problem. I'll discuss some of the main architectural choices and describe what sort of problem each is best suited to solve; after that, the description of the Circuit Cellar supercomputer will make more sense.

A scalar is a mathematical term indicating a value that can be expressed as a single number. A scalar computer, therefore, can work on a single number at a time. You are probably most familiar with scalar processors, although you may never have thought of your computer in quite that way before. All the examples in the previous sections have dealt with scalar processor design.

A *vector* is a value that must be expressed with two or more numbers. For example, the coordinates for a point in space consist of three numbers: the distance from the origin along the x, y, and z axes. The notion of a vector is more flexible than that, though, and can describe *continued* 



**Figure 8:** In a final attempt to improve throughput, pipelining is added to the CPU.

Fetch Fetch Fetch Fetch I-fetch ADD-2 ADD-3 ADD-4 ADD-1 Decode Decode Decode Decode CPU I-decode ADD-1 ADD-2 ADD-3 ADD-4 pipeline Fetch Fetch Fetch Fetch D-fetch mem1-1 mem1-2 mem1-3 mem1-4 Store Store Store Store D-store reg1-4 reg1-1 reg1-2 reg1-3 One machine cycle

Figure 9: The CPU from figure 8 executes a series of ADD mem1, reg instructions.



# Don't Be A Clone Alone.

The largest group of IBM-compatible users in the world shares its problems and solutions online every day in CompuServes IBM\* and Tandy\* Forums. And you can join them.

Find out what hardware and software works best with your system, and what quirks to expect before buying it. Then work out the bugs with someone who has already solved the problem.

Are you going to end up paying more for a low-price peripheral, or have you really found an outstanding deal? Ask someone who's bought one.

Questions about printer compatibility? Add-on boards? Visit a CompuServe IBM or Tandy Forum and get the answers. There's no better way to get more out of your computer.

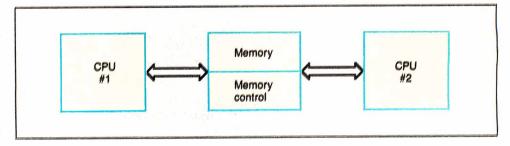
To join CompuServe, see your computer dealer. To order direct or for more information, call 1 800 848-8199. In Ohio and Canada, call 1 614 457-0802. If you're already a member, type GO IBMNET or GO TANDYNET at any! prompt.

CompuServe\*

An Hall Block Company

Figure 10: Two processors connected to a common memory. Access to the memory is regulated by a memory control.

Figure 11: Both CPUs of the system described in figure 10 execute ADD instructions. ▼



Fetch Fetch Exec Store Decode Fetch Idle Idle Idle **CPU #1** mem3 instr. instr. instr. mem1 mem2 Wait Decode Wait Fetch Fetch Exec Store Wait Fetch **CPU #2** mem6 mem5 instr. instr. instr. mem4 One CPU or memory cycle on either processor

Figure 12: A four-way tightly coupled multiprocessor system.

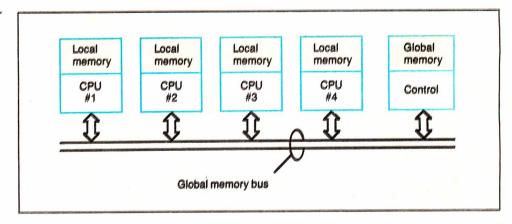


Figure 13: A four-way direct-connected multiprocessor system.

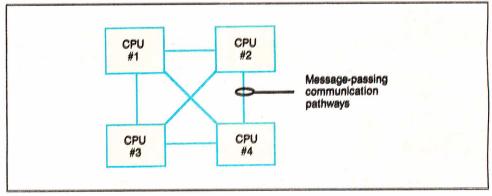
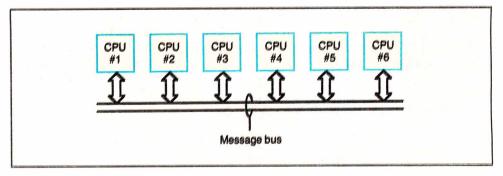


Figure 14: A multiprocessor system consisting of six CPUs connected via a common message bus.



points with hundreds or thousands of associated numbers.

A vector processor includes enough hardware to perform computations on all (or at least many of) the numbers for each point at one time. A machine with three ALUs could add all three coordinates of two points simultaneously, delivering the result in one-third the time of a scalar processor with one ALU.

All the ALUs in a vector processor perform the same operation on each of the vector's components. Many problems involving vectors need exactly this sort of lock-step processing, but some simply need more freedom. Although you can create some variations, in general, all the ALUs in a vector processor must do the same thing at the same time. This means that some problems simply don't fit the vector processor pattern.

The solution to problems that need more performance than the best scalar processor can provide, but are too unruly for a vector processor, can often be handled by a true multiprocessor system. Unlike scalar and vector machines, though, the exact design of a multiprocessor system determines what type of problems it can handle. In fact, some multiprocessors on the market are so specialized that they can solve only one class of problem.

The distinguishing feature of a multiprocessor system is that—unlike a vector system—the processors are all executing different instructions on different data. There's no centralized control determining which instruction to use on what data.

Although using multiple processors on a single problem can provide a dramatic performance improvement, not all problems will respond to this sort of treatment. For example, a program that computes the factorial of a number by recursive calls can't be split up on multiple processors, because each result depends on the preceding one. A word processor won't attain a dramatic speed increase on a multiprocessor system, because most of the time the software is waiting for keystrokes. (You could speed up reformatting by assigning one paragraph to each processor, but that's not a convincing application.)

It's worth pointing out that, regardless of the type of multiprocessor system, each individual processor can be any sort of scalar processor you'd like to use. Any and all of the tricks described earlier to crank up scalar performance are fair game in multiprocessor applications. The only catch is that, because the system has many processors, the cost goes

up dramatically as each processor becomes more complex. Sometimes, as we'll see next month, many simple processors can outperform fewer complex ones.

And, as I mentioned above, the design of a multiprocessor system determines the types of problems it can handle with greatest efficiency. Just as with caches and pipelines, some problems will actually run slower on a multiprocessor than on a scalar machine.

### **Tightly Coupled Multiprocessors**

Any multiprocessor system starts with two or more scalar machines. Figure 10 shows two simple processors connected to a common memory, which is similar to the simple DRAM we started with in figure 1. Because the memory can handle only one access at a time, a memory controller must decide which processor will get access to the memory on each cycle. If the processors access the memory simultaneously, one must wait until the other is finished.

Figure 11 shows what happens when these two processors both start executing different ADD instructions with three memory operands each. This is the same situation described in figure 2, but now you can see the lost time when CPU #2 is locked out of the common memory by an access from CPU #1. The two ADD instructions take 9 cycles to complete, where two on a pure scalar machine take 12 cycles.

Doubling the number of processors should increase performance by 100 percent, but it went up only 33 percent (% compared to  $\frac{2}{12}$ ). What went wrong?

Even though the processors are executing separate instructions with different data addresses, both processors must access the shared memory to get information. Because it is possible for the memory to handle only one request, the system is running at only half efficiency when both processors need the memory simultaneously.

There are two solutions to this problem: The memory can become complex enough to handle two accesses at once, or the processors can reduce the number of memory accesses required for each instruction. Each solution raises additional problems, but the latter choice is the only practical one for systems that use more than a few processors. Imagine building a memory that can support a dozen simultaneous accesses.

Figure 12 shows a four-way multiprocessor. Each processor has a local memory for its program and working variables. Results and status flags are stored

in common memory, which is accessed over the global memory bus connected to each processor. The memory controller decides which of the four processors will gain access during each memory cycle. Processors that lose the battle for access to common memory must wait for the next free memory cycle.

Because each processor has direct access to the global memory, this is an example of a tightly coupled multiprocessor system. The tightest of coupling is the limiting case occurring when the processors have no local memory. Each processor can change the state of any other processor's computation by simply writing new data in the right addresses. As you can imagine, this may not be an entirely good thing, particularly for debugging errant programs.

The hardware problem with this architecture is that the global memory bus requires a large number of signal lines. If the processors use 32-bit words and the global memory has only 1 megabyte, the bus needs over 50 lines for just the data and address. High-frequency transmission-line techniques are required to extend this bus more than a few feet, so there is a distinct limit to the number of processors that can connect to a single global memory bus.

For problems that demand a large number of processors, there is no feasible way to connect each processor to a shared high-bandwidth memory bus. Worse, the contention for that memory will begin to wipe out the advantage of multiple processors (remember the simple example in figure 11). Again, there must be a better way.

### **Loosening the Bonds**

The best performance for a tightly coupled multiprocessor architecture occurs when you are running programs that don't need much access to the global memory. If that is indeed the case, the wide, fast, expensive global memory bus can be replaced by a relatively narrow connection between processors. The ultimate reduction is a bidirectional serial link, but it could be a byte-wide or wordwide channel with some handshaking control lines.

Figure 13 shows a four-way multiprocessor connected by narrow ports between each pair of processors. Because each link has a relatively low bandwidth compared to the previous global memory bus, the processors can exchange only limited amounts of data. But for problems with fairly strict partitioning, this works reasonably well.

continued

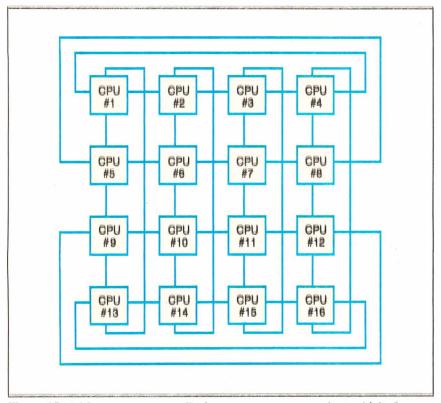


Figure 15: A 16-processor system. Each processor can communicate with its four closest neighbors.

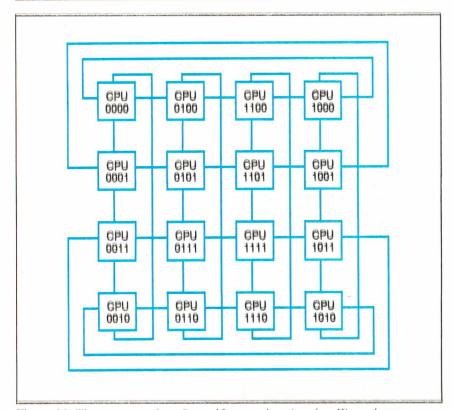


Figure 16: The processors from figure 15 are each assigned an ID number to simplify message passing.

Connecting each processor to all the others simplifies the task of exchanging data, but it requires n-1 ports on each processor. For four processors this is feasible, but I challenge you to draw the connections for a 16-processor system. For lots of small processors, there's a problem fitting all the connections into the available physical space.

One way around this is to connect all the processors to a common "message bus," as shown in figure 14. Although the figure looks much like figure 12, the difference is that the common bus is relatively narrow and doesn't connect to a global memory. Any processor can send a message to any group of the others, but only one transmitter can be active at any one time.

You'll notice a striking resemblance between figure 14 and the standard block diagram for a local-area network. In fact, although LANs are usually thought of as a way to share peripherals, they're also useful for coordinating the work of many processors. I've seen some work that uses otherwise idle computers on a LAN to perform "background" computations on a complex problem, shifting the calculations around the network to take best advantage of the available hardware.

The problem with a LAN, of course, is that there can be only one message active at a time. Regardless of the LAN bandwidth, there will be some lost time when the processors queue up to use that single resource.

Figure 15 shows one way around this problem. Each processor can send messages to its four closest neighbors, with processors on the edges of the array wrapped around to the other side. Depending on how the processors are programmed, each can support up to four messages at once. If the code is particularly clever, any processor can send a message to any other one by routing it along the shortest distance between the two.

That layout will work if most of the messages are to adjacent processors. Sending a message across the entire array will involve all the processors between the two nodes, and the overhead involved in figuring out the proper path can be significant. A slightly different way of connecting the processors can improve message passing, at the cost of greater wiring complexity.

Figure 16 looks almost the same as figure 15, with each processor linked to four others. If you look closely, you'll see that the processor numbers differ by only 1 bit across each link. That change

#### CIARCIA'S CIRCUIT CELLAR

makes the message-routing problem almost trivial.

When a processor receives a message, it compares the destination address in the message header with its own address by performing an exclusive-OR. If the result is 0, the two addresses are the same and it can process the message. If the result isn't 0, the message must be forwarded to another processor. The processor sends the message to the neighboring processor that has an address differing in that same bit position.

Using this method, you can interconnect 65,536 processors with only 16 links per processor and a maximum message delay of 16 transmissions. This seems to be the best way to connect truly large arrays to minimize transmission delay without unduly complicating the backplane wiring.

#### **Communication Bottlenecks**

What should be obvious from these sample systems is the need to figure out just what level of communication will occur between the processors. A large communication volume requires high-bandwidth connections, with the attendant complexity of common memory design. Programs with shorter, less frequent messages between fewer processors can run effectively on processors with "narrower" links, perhaps using message passing between links to reduce the number of distinct connections.

A multiprocessor system must be designed to solve a particular class of problems. Ideally, it will handle that class with particular efficiency (although every now and again the designers find that there's a skeleton in the closet that hampers performance). Attempting to fit a problem from a different class onto that machine will result in poor performance, perhaps even lower than on a scalar machine.

#### **Upcoming Events**

If you're at all familiar with the calculations behind the Mandelbrot set, you can probably tell why I elected to use it as the foundation for a supercomputer. A single image requires massive amounts of computation, but it can be easily divided between an arbitrary number of processors. The results of the computations can be summarized by 1 or 2 bytes, so the output data transmission can use a relatively slow link. Even better, the algorithm doesn't need any communication between neighboring processors, so the interprocessor communication isn't a critical issue.

In the next part of this project, I'll de-

scribe the system architecture of the Circuit Cellar Mandelbrot engine and explore the mathematics and algorithms behind its operation. In the concluding part, I'll cover the array hardware and the control/display software for the Mandelbrot engine.

Special thanks to Ed Nisley and Merrill Lathers for their expert contributions to this project.

Editor's Note: Steve often refers to previous Circuit Cellar articles. Most of these past articles are available in book form from BYTE Books, McGraw-Hill Book Co., P.O. Box 400, Hightstown, NJ 08250.

Ciarcia's Circuit Cellar, Volume I covers articles in BYTE from September 1977 through November 1978. Volume II covers December 1978 through June 1980. Volume III covers July 1980 through December 1981. Volume IV covers January 1982 through June 1983. Volume V covers July 1983 through December 1984. Volume VI covers January 1985 through June 1986.

#### Circuit Cellar Ink

It's virtually impossible to provide all the pertinent details of a project or cover all the designs I'd like to in the pages of BYTE. For that reason, I have started a bimonthly supplemental publication called Circuit Cellar Ink, which presents additional information on projects published in BYTE, new projects, and supplemental applications-oriented materials. For a one-year subscription (6 issues), send \$14.95 to Circuit Cellar Ink, 12 Depot Square, Peterborough, NH 03458. Credit card orders can call (203) 875-2199.

There is a multiline Circuit Cellar bulletin board system (running TBBS 2.0M) that supports past and present projects in BYTE and Ink. You are invited to call and exchange ideas and comments with other Circuit Cellar supporters. The 300-/1200-/2400-bps BBS is online 24 hours a day at (203) 871-1988.

To receive information about the Circuit Cellar Ink publication for hardware designers and developers, please circle 100 on the Reader Service inquiry card at the back of the magazine.

Steve Ciarcia (pronounced "see-ARE-see-ah") is an electronics engineer and computer consultant with experience in process control, digital design, nuclear instrumentation, and product development. The author of several books on electronics, he can be reached on BIX as "sciarcia."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

## Protect Your Copies of BYTE

#### NOW AVAILABLE:

Custom-designed library *files* or *binders* in elegant blue simulated leather stamped in gold leaf.

Binders—Holds 6 issues, opens flat for easy reading. \$9.95 each, two for \$18.95, or four for \$35.95.





Files—Holds 6 issues. \$7.95 each, two for \$14.95, or four for \$27.95.



### Order Now!

Mail to: Jesse Jones Industries, Dept. BY, 499 East Erie Ave., Philadelphia, PA 19134

Please send files;
binders for BYTE magazine.
Enclosed is \$ Add \$1 per
file/binder for postage and handling.
Outside U.S.A. add \$2.50 per file/binder
(U.S. funds only please).
Charge my: (minimum \$15)
American Express Visa
MasterCardDiners Club

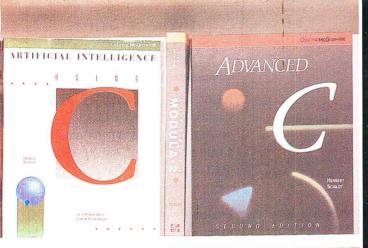
Card # \_\_\_\_\_ Exp. Date \_\_\_\_ Signature \_\_\_\_\_ CALL TOLL FREE (24 hours):

1-800	-972-5858
Name	
Address	(No P.O. Box)
City	-
State	Zip
Satisfaction guarante	

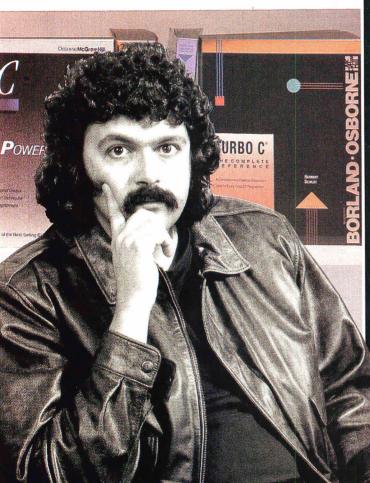
Pennsylvania residents add 6% sales tax Allow 5-6 weeks delivery in the U.S.











# See C Writer.

Herb Schildt is the author that over 600,000 programmers turn to for the word on languages. That's because Schildt's expertise in programming is unprecedented. And he is unsurpassed in C. In fact, out of the 21 books Herb's published, all 9 of his books on C are bestsellers. Find out why over 600,000 programmers can't be wrong. See C Writer, Herb Schildt.

"Schildt's books offer first rate material"
Computerworld

"... Noted author and veteran C programmer ... produce(s) the kind of book programmers like best ..."

Philippe Kahn, President, Borland International, Inc.

From the Foreword of Using Turbo C

C: The Complete Reference \$24.95, ISBN 0-07-881263-1

C: Power User's Guide \$22.95, ISBN 0-07-881307-7

Artificial Intelligence Using C \$21.95, ISBN 0-07-881255-0

Advanced C, Second Edition \$21.95, ISBN 0-07-881348-4

Turbo C: The Complete Reference \$24.95, ISBN 0-07-881346-8

Turbo C: The Pocket Reference \$5.95, ISBN 0-07-881381-6

Tarbo C. The Focket Reference \$5.75, 15Bit C Of 501501

C: The Pocket Reference \$5.95, ISBN 0-07-881321-2 Using Turbo C \$19.95, ISBN 0-07-881279-8

Advanced Turbo C \$22.95, ISBN 0-07-881280-1

Just Released-

OS/2™ Programming: An Introduction

\$21.95, ISBN 0-07-881427-8

For a Free Catalog with More Information on All 21 Books Written by Herb Schildt

## Call Toll-Free 800-227-0900

Visa, MasterCard, American Express Accepted for Orders. Include local tax and \$2.00 for shipping.



Osborne McGraw-Hill

2600 Tenth Street Berkeley, California 94710

Trademarks: OS/2 is a trademark of International Business Machines Corp. Turbo C is a registered trademark of Borland International, Inc. Copyright@1988 McGraw-Hill, Inc.

Part 2

## FLOATING-POINT WITHOUT A COPROCESSOR



Emulating a math chip is fine, but you still need some way to talk to the outside world

ast month I introduced a binary floating-point mathematics package and described the code for the four primary math operations: addition, subtraction, multiplication, and division. Using those routines, you can build the more complex functions-transcendentals and trigonometrics, for example—that you find in highlevel languages.

But there are a couple of ingredients still missing from the recipe. Although you can manipulate floating-point numbers with the functions I've given, you need to be able to get numbers to and from the routines. I can remember when I toggled in my first program on my old Altair 8800's front panel and showed my mother its results on the accumulator

"Look, Mom! That light means a 2, that one means an 8, and that light means a 16, for a total of 26!'

"That's nice, dear."

A mathematics package with no easy way to get the numbers in or out is not much better. It's time for some I/O.

#### Inside/Outside

As you'll recall from last month, the floating-point format I've defined accommodates storage for a 15-bit exponent, an 80-bit mantissa, and a 1-bit sign (which needs a separate byte of its own; you may want to refer to the diagram on page 314 of last month's BYTE). All this requires 13 bytes of storage per number local to the package. I referred to this storage area as the floating-point accumulators, FAC1 and FAC2.

However, a program that calls the

package is not likely to want to allocate 13 bytes of storage for each floatingpoint number: A large array of such numbers can consume memory rapidly. And the format I've described uses an entire byte to hold the mantissa's sign. This is necessary only to make the execution of floating-point operations faster. When a number is being stored externally—waiting around until you use it again—it doesn't make sense to use 8 bits to store the sign when 1 bit will do.

Listing 1 shows the pseudocode for a pair of routines called LDFACC and STFAC1. LDFACC loads one of the two floating-point accumulators (selected by the DI register) from an external memory location, assuming that the number at that location is in external floating-point form. STFAC1, the reverse of LDFACC, stores the number in FAC1 to an external location. I didn't provide a routine for storing FAC2 anywhere, because the four operations I've so far defined all leave their results in FAC1.

The external representation the package uses is very close to the 10-byte extended format used by the Apple Macintosh's Standard Apple Numeric Environment library (which is compatible with the IEEE 10-byte extended definition). My numerics package doesn't define special cases like NAN (not-a-number) and infinity as defined in SANE, but some intrepid programming could add such entities; in fact, you can make the package compatible with whatever you want.

Most of these routines' time is spent shifting and masking. The external representation stores the mantissa's sign in the highest bit of the exponent (a bit that, internally, is used to detect exponent overflow). Also, since the normalization routine I presented last month aligns the mantissa so that its topmost bit is 0 (to catch overflow), STFAC1 shifts the mantissa before storing so you don't waste space storing an empty bit.

Actually, you can grab one more bit's

worth of accuracy in the external representation if you consider that, unless the floating-point number is true zero, after one shift to the left the most significant bit of the number must be a 1. You could rewrite STFAC1 to perform a second shift before it stores the number. Then, rewrite LDFACC to recover those top 2 bits by shifting the mantissa to the right twice and setting the highest 2 bits to 01 binary. The IEEE and Microsoft formats for encoding short and long real numbers use this trick.

You can modify the load and store routines to customize your own external representations (or adhere to those of some other commercial numerics library). Perhaps you don't need a 64-bit mantissa's worth of accuracy-you'd prefer handling lots of less-precise numbers quickly, rather than take more time for a few really precise ones. In this case, you can lop bytes off the mantissa from the right—but keep in mind that for every bit you give up in the mantissa, you lose about one-third of a decimal digit's worth of accuracy. If you want to store the exponent in a byte rather than a word, you'll certainly have to pick a smaller bias value (128 comes to mind, since that number divides a byte's range: 0 to 255) and write some routines for translating to and from byte-wide and word-wide exponents.

#### Incoming

Getting a floating-point number into the package from the outside—typed in from the keyboard or read from a file—simply requires a routine to read a character string representing a floating-point number and translate that number into the package's internal representation. You can break this requirement down further into a series of simpler requirements: The routine must read and translate signs (+ or -), a mantissa, and an exponent.

The routine I've provided reads a character string whose format can handle any

continued

floating-point number that the package is

capable of handling. I haven't built a

great deal of flexibility into the input routine—it likes its strings just so—but

## **Listing 1:** Pseudocode for the LDFACC and STFAC1 routines that move numbers to and from the floating-point accumulators.

```
(Assumes SI points to number, DI points to SIGN field of
the floating-point accumulator to store.)
(Set the sign field)
Set byte at [DI] based on high bit of byte at [SI];
Move the number into the accumulator;
Clear lowmost word of mantissa;
Clear highmost bit of exponent;
Shift mantissa right 1 bit;
STFAC1:
(Assumes DI register points to destination.)
Shift FAC1 MAN left 1 bit;
IF FAC1 SIGN = 0 THEN FAC1 EXP = FAC1 EXP AND 7FFFH;
ELSE
   FAC1 EXP = FAC1 EXP OR 8000H;
Move the number out of FAC1, exponent first, followd by
 the top 4 words of the mantissa; (Since FAC1_EXP and
 FAC1 MAN are contiguous, this uses an REP MOVSW
 instruction.)
RETURN;
```

#### **Listing 2:** Inputting a floating-point number.

```
CH = NextCHAR;
IF CH = '+' THEN FAC1 SIGN=0; ELSE FAC1_SIGN=128;
DEC EXP=0:
FAC1 MAN=0;
CH = NextCHAR;
CALL ADDIGIT (CH);
CH = NextCHAR; (Skip decimal point)
REPEAT
 BEGIN
   CH = NextCHAR;
   IF CH is not a digit THEN GOTO FPI1;
   CALL ADDIGIT (CH);
   DEC_EXP=DEC_EXP-1;
 END
FPI1:
(The next line skips the "E" and reads the exponent sign.)
  CH = NextCHAR;
  IF CH = '+' THEN EXP SIGN=0; ELSE EXP SIGN=128;
  EXP VAL=0;
  REPEAT
   BEGIN
    CH = NextCHAR;
    IF CH is not a digit THEN GOTO FPI2;
    EXP VAL = 10 * EXP_VAL + VALUE(CH);
   END
 FPI2:
  IF EXP SIGN = 0 THEN
    DEC EXP = DEC EXP + EXP VAL;
     DEC EXP = DEC EXP - EXP_VAL;
  FAC1 EXP=BIAS+79;
  CALL NORM1;
  FAC2 = 10.0
  IF DEC EXP > 0 THEN
   REPEAT DEC EXP TIMES
     CALL FPMULT;
  IF DEC EXP < 0 THEN
   REPEAT ABS (DEC EXP) TIMES
     CALL FPDIV;
  RETURN;
                                                          continued
```

I'll point out places where you should have no problem extending the software to handle freer entry formats. While I'm on the subject of formats, here's the format that my input routine expects:

sD.DDDDEsDDD<null>

where s is a sign (+ or -), D is a digit (0 or -)to 9), <null> is the null character (ASCII 0), "." is a decimal point, and E is E (which signals that the exponent portion follows). If you've done any engineering or scientific programming, you'll feel right at home with this format. You can see that a number is written as the sign of the mantissa, followed by the mantissa, followed by E, followed by the sign of the exponent, followed by the exponent. As I mentioned before, my input routine is fairly inflexible, so none of this is optional. You must write 1 as +1.0E+0; 5000 as +5.0E+3; -.0045as -4.5E-3; and so on.

Listing 2 shows the pseudocode for the input routine. NextCHAR is a fictitious function that returns the next character from the input string (in the actual code, the SI register points to the input string, so the NextCHAR function is actually a LODSB instruction). Once FPINPUT translates the sign of the mantissa, it simply grabs each mantissa digit from the input string and adds it into FAC1's mantissa. (Like the other routines in the package, this routine returns with the inputted number stored in FAC1.) As each digit is added in, the routine treats FAC1\_MAN not as a binary fraction but as a large binary integer. In effect, the routine ignores the decimal place; it remembers where it is by counting how many digits appear to the right of the decimal point. This value is kept in DEC\_EXP.

Next, the routine reads the exponent sign and exponent value. This process is a miniature version of what's just gone on in the mantissa. For the exponent: Get a digit, multiply the accumulated exponent value by 10, add the new digit in, and repeat. Once the routine has successfully converted the ASCII exponent to binary, it adds that amount into DEC\_EXP.

Now it's a cleanup job. The routine has all the numbers it needs. First, it normalizes the contents of FAC1\_MAN. Notice the value loaded into FAC1\_EXP prior to normalization to reflect the fact that the number in the mantissa is an integer—that is, that the binary point is to the right of the least significant bit. Then the rou-

tine loads a floating-point 10.0 into FAC2 and, depending on the sign of DEC\_EXP, either multiplies or divides FAC1 repeatedly by 10.

You now have a binary floating-point

number in FAC1.

My routine requires one digit to the left of the decimal point. Modifying the algorithm to accept any number of digits to the decimal point's left should be trivial. It would also be simple to recode things so that signs are not required; no sign would indicate an implied plus sign. Finally, you could have the routine assume a zero exponent if it encountered the end of the string before running into an E.

Outgoing

Once you've done all sorts of complicated floating-point calculations, you need a way to examine the results of your cipherings. You need the reverse of the input routine: something to convert a floating-point number to an ASCII char-

acter string (see listing 3).

The output algorithm works like this: Remember that the internal representation of the floating-point numbers is in base 2, so we need to somehow extract the base-10 exponent portion of the number. We already know the internal representation for 10.0 (we used that in our input routine), so we can perform a series of multiplications or divisions by 10 until the number falls somewhere between 1 and 16. You can tell when the number is in this range by watching the exponent (in this case, FAC1\_EXP minus the bias amount), which tells you how many digit positions the binary point is from the number's most significant bit. For example, if  $FAC1\_EXP = BIAS + 5$ , you know the number looks like bbbbb.bbbbb... (where b is a bit, 1 or 0). If  $FAG1_{EXP} =$ BIAS -2, the number looks like this: 0.00bbbbbbbbbb... (where the leftmost b is the most significant digit).

Each time the routine performs a multiplication (or a division) by 10, it increments (or decrements) DEG\_EXP. In this way, the routine determines the num-

ber's base-10 exponent.

The routine's next step is to narrow the number's range even further by verifying that it is between 1 and 10. If the number is greater than 10 (it cannot be less than 1 because of what the routine has done to the number so far), FPOUTPUT does one more division by 10. Now the routine adjusts the number so that the binary point is between bits 75 and 76, and the top 4 bits of the number are its integer portion. And thanks to all the continued

RETURN

```
ADDIGIT:

CALL FAC1x10;

FAC1_MAN = FAC1_MAN + VALUE(CH);

RETURN;

FAC1x10:

(This routine multiplies FAC1's mantissa by 10 using the identity 10*x=8*x+2*x.)

Shift FAC1_MAN left 1 bit;

FAC3_MAN = FAC1_MAN;

Shift FAC1_MAN left 2 bits;

FAC1_MAN = FAC1_MAN + FAC3_MAN;

RETURN;
```

```
Listing 3: Pseudocode for the floating-point output routine.
FPOUTPUT:
 DEC EXP=0;
 IF FAC1 EXP=0 THEN GOTO FOUT1;
 FAC2=10.0:
(Note: The comparisons in the following two WHILE
 statements treat FAC1 as a positive number.)
 WHILE FAC1 > 15
  BEGIN
   CALL FPDIV:
   DEC EXP=DEC EXP+1;
  END
 WHILE FAC1 < 1
  BEGIN
   CALL FPMULT;
   DEC EXP=DEC EXP-1;
 IF FAC1>=10 THEN
  BEGIN
   CALL FPDIVE
   DEC EXP=DEC EXP+1;
(Set binary point between bits 75 and 76.)
 IF FAC1 EXP=BIAS+4 THEN
  Shift FAC1 MAN left 1 bit;
  WHILE FAC1 EXP < BIAS+3
   BEGIN
    Shift FAC1 MAN right 1 bit;
    FAC1 EXP=FAC1 EXP+1;
 ROUND FAC1 MAN;
FOUT1:
 IF FAC1 SIGN = 0 THEN OUTPUT ('+');
 ELSE
    OUTPUT ('=');
 CH = Leftmost nibble of FAC1 MAN;
 OUTPUT (ASCII (CH));
 OUTPUT('.');
 REPEAT N TIMES
   BEGIN
     Clear leftmost nibble of FAC1 MAN;
     CALL FAC1x10#
     CH = Leftmost nibble of FAC1 MAN;
     OUTPUT (ASCII (CH));
   END
 OUTPUT ('E');
 IF DEC EXP>=0 THEN OUTPUT ('+');
 ELSE
    OUTPUT ('-');
 OUTPUT (Integer to ASCII (ABS (DEC EXP)));
```

multiplying and dividing by 10 that's gone on, we know that the integer portion of the number must be between 1 and 10-that is, a single decimal digit.

The rest of the job is a snap. Since you've isolated your first digit in the top 4 bits, you simply strip those bits out, convert binary to ASCII, and output the character. Then you multiply the mantissa by 10, strip the top 4 bits out again, and keep up the process until you have however many digits you need. (Warn-

ing: Do not use the package's FPMULT routine to do this multiplication, since FPMULT exits through the normalization routine, which would reset the binary point. Instead, you should use the fact that  $10 \times x = 2 \times x + 8 \times x$  and implement the multiplication as a series of shifts and adds. Check out the pseudocode for routine FAC1 × 10.) The decimal exponent portion is waiting for you in DEC\_EXP, so just output it using an integer-to-ASCII routine (the details of

which I won't go over here, since there are plenty of sources for such algorithms), and you're all done.

The only thing I've glossed over is rounding (the pseudocode shows it as ROUND FAC1\_MAN). There are various ways you can go about rounding the number for output; the choice depends on what sort of accuracy you're looking for. If you modify FPOUTPUT to be part of some formatted numeric output package, you'll have to add code to determine which digit to round on. This will depend on how many digits a particular calling routine requests to output. My math package's output routine simply adds 5 × 10<sup>-19</sup> to the number in the mantissa since, as I said earlier, a 64-bit mantissa gives about 19 digits of accuracy. (It does this by adding 9393 hexadecimal to the least significant word of FAC1\_MAN and rippling any carries on up the rest of the mantissa.)

#### Left as an Exercise

Carnivorous floating-point addicts may want to extend the package even further. This is understandable; there are plenty of functions involving floating-point numbers that I haven't covered here. Some of the more esoteric are beyond what I have room to present. Other, more recognizable functions are quite easy to implement:

- Integer-to-floating-point: The clue to this is hidden in the floating-point input routine. First, you check the sign of the integer, store that in FAC1\_SIGN, and, if it's negative, convert the integer to a positive number. You move the integer into FAC1\_MAN-right-justified, so that the low word of the integer is in the rightmost word of FAC1\_MAN. Then you load FAC1\_EXP with the value BIAS+79 and call the normalization routine.
- · Floating-point-to-integer: Load the number into FAC1 using LDFACC and examine FAC1\_EXP. If FAC1\_EXP is less than or equal to BIAS, forget it-the number has no integer part. Otherwise, FAC1\_EXP - BIAS tells you how many bits, starting with bit 78 and moving to the right, are the integer portion. For example, if  $FAC1\_EXP - BIAS = 5$ , then bits 78 through 74 form the integer (with bit 78 being most significant). Do a looping shift operation and a final check with FAC1\_SIGN to see if you have to negate things, and you're there.
- Floating-point comparisons: Comparison operations-greater than, less than, equal to, and so on-are easily done using the floating-point subtract routine

continued

# PolyAWK The Toolbox Language

For C, Pascal, BASIC, Assembler, FORTRAN & dBASE programmers.



MS-DOS

Programmers, engineers and scientists are using PolyAWK to replace a host of specialized tools and programs. You will still use standard languages like C or Assembler to develop applications, but this versatile, simple and powerful language will become an indispensable part of your toolbox. Alfred Aho, Richard Weinberger and Brian Kernighan of Bell Labs developed AWK for UNIX. PolyAWK, for MS-DOS fully conforms to the AWK standard as defined by the authors in their book, The AWK Programming Language, which functions as the user's manual.

#### A Pattern Matching Language

PolyAWK is a powerful pattern matching language for writing short programs to handle common text manipulation and data conversion tasks, multiple input files, dynamic regular expressions, and user manipulation and data conversion tasks, multiple input files, dynamic regular expressions, and user defined functions. A PolyAWK program consists of a sequence of patterns and actions that tell what to look for in the input data and what to do when it's found. PolyAWK searches a set of files for lines or strings matched by any of the patterns. When a match is found, the corresponding action is performed. A pattern can select lines by combinations of regular expressions and comparison operations on strings, numbers, fields, variables and array elements. Actions may perform arbitrary processing on selected lines. The action language looks like C, but there are no declarations, and strings and numbers are built-in data types.

#### Concise Code Saves You Time & Effort

The most compelling reason to use PolyAWK is that you can literally accomplish in a few lines of code what may take pages in C, Pascal, BASIC, FORTRAN or Assembler. The brevity of expression and convenience of operations make PolyAWK valuable for prototyping even large sized programs.

### Math Support & Large Model Implementation

PolyAWK includes extensive support for math functions such as strings, integers, floating point numbers and transcendental functions (sin, log, etc.) for scientific applications. PolyAWK is a large model implementation and can use all of available memory to run programs or read files greater than 64K.

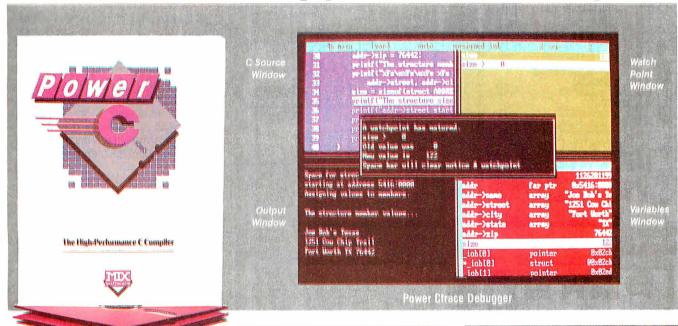
### 30 Day Money Back Guarantee

Credit Card Orders: 1-800-547-4000 Ask For Dept. BYT Send checks and P.O.s To: POLYTRON Corporation 1700 NW 167th Place, Beaverton, OR 97006 (503) 645-1150 FAX: (503) 645-4576



High Quality Software Since 1982

## How to create high-performance programs without wasting your time or money



### Step 1: The \$19.95 Power C compiler

Power C is the new ANSI compatible C compiler that runs faster than Microsoft C and has more functions than Turbo C®. Power C combines high-performance software with superb documentation, all for less than the price of most C books alone. It's your fast route to fast programs without the fast bucks. Compare Power C to the competition and see how much time and money you'll save.

Performance/Price Chart (execution times in seconds)								
	Power C	Quick C®	Turbo C®					
1) fib	23.8	53.4	26.4					
2) sieve	27.6	43.2	25.5					
3) tdbl	3.5	9.0	9.6					
4) diskio	13.5	14.4	14.3					
5) report	11.0	71.7	60.7					
6) drystone	36.6	41.6	31.8					
Compile/Link	73.9	113.5	81.4					
EXE File Size	25120	32092	27184					
Compiler Price	\$19.95	\$99.00	\$99.95					
Debugger Price	\$19.95	N/C	N/A					
Library Source	\$10.00	\$150.00	\$150.00					
Total Cost	\$49.90	\$249.00	\$249.95					

N/C no charge - N/A not available Benchmarks compiled using Make utility, command-line compiler. and medium memory model



### Step 2: The \$19.95 **Power Ctrace debugger**

Power Ctrace is the new state-of-the-art C debugger that makes Microsoft's Codeview look like old technology. Power Ctrace will reduce the time you spend debugging your C programs by at least a factor of 10. With Power Ctrace, you'll be working smarter instead of harder. Actually, you'll be having so much fun that it won't even feel like work anymore.

Unlike other debuggers, Power Ctrace lets you debug graphics programs on a single monitor. You can even debug programs that write directly to video memory. However, the major advantage of Power Ctrace is simple operation. You won't waste any time trying to understand or remember cryptic commands. With Power Ctrace, a single keystroke is all it takes. Help screens show you which key to press and pop-up menus list your options. Invest just 10 minutes with Power Ctrace now and you'll save hours from now on.



Technical Specifications
Power C includes: Power C compiler with integrated Make.
Power C Linker, Power C Libraries (450 functions), the Power C book (680 pages), and support for ...

ANSI standard IEEE floating point 8087/80287 coprocessor auto-sensing of 8087/80287 automatic register variables

unlimited program size mixed model (near & far pointers) graphics on CGA, EGA, VGA, & Hercules

Optional Products:

Power Ctrace debugger Library source code BCD business math

Order now by calling our toll free number or mail the coupon to Mix Software, 1132 Commerce Drive, Richardson, TX 75081.

### 1-800-333-0330

For technical support call: 1-214-783-6001

Minimum System Requirements: DOS 2.0 or later, 320K memory. 2 floppy drives or hard drive Runs on IBM PC. XT. AT. PS/2 and compatibles.

Name Street City State Zip Telephone Ax Discove Paying by: Money Order Chec Card # Card Expiration Date Computer Name Disk Size Dower C compiler (\$19.95) Power C compiler (\$19.95) Power C compiler (\$19.95) Department of yource Code (\$10.00) Cincludes assembler & library manager) BCD Business Math (\$10.00) Add Shipping (\$5 USA - \$20 Foreign) Texas Residents add 8% Sales Tax Total amount of your order Power C & Power Cirace are trademarks of Microsoft Copp Turbo C is a registered trademarks of Microsoft Copp Turbo C is a registered trademarks of Microsoft Copp Turbo C is a registered trademarks of Microsoft Copp	60	day money	y back guarai	ntee
City   State   Zip   Telephone   Paying by:   Money Order   Chec   Card #   Card Expiration Date   Disk Size   Dis	Name			
State Zip Telephone Paying by: Money Order Chec Token Money Chec Token M				
Telephone Paying by:	State		Zin	
Card # Card Expiration Date Computer Name  Disk Size    5½"   3½"  Product(s) (Not Copy Protected)   Power C compiler (\$19.95)   5     Power Ctrace debugger (\$19.95)   5     Library Source Code (\$10.00)   5     (includes assembler & library manager)   8CD Business Math (\$10.00)   5     Add Shipping (\$5 USA - \$20 Foreign)   5     Texas Residents add 8% Sales Tax   5     Power C & Power Ctrace are trademarks of Microsoft Copp	Telephone		- 111	
Card # Card Expiration Date Computer Name  Disk Size    5½"   3½"  Product(s) (Not Copy Protected)   Power C compiler (\$19.95)   5     Power Ctrace debugger (\$19.95)   5     Library Source Code (\$10.00)   5     (includes assembler & library manager)   8CD Business Math (\$10.00)   5     Add Shipping (\$5 USA - \$20 Foreign)   5     Texas Residents add 8% Sales Tax   5     Power C & Power Ctrace are trademarks of Microsoft Copp	Paying by:	□ M	oney Order	☐ Chec
Card # Card Expiration Date Computer Name  Disk Size    5½"   3½"  Product(s) (Not Copy Protected)   Power C compiler (\$19.95)   5     Power Ctrace debugger (\$19.95)   5     Library Source Code (\$10.00)   5     (includes assembler & library manager)   8CD Business Math (\$10.00)   5     BCD Business Math (\$10.00)   5     Texas Residents add 8% Sales Tax   5     Power C & Power Ctrace are trademarks of Microsoft Copp	Visa	□ MC	☐ AX	☐ Discove
Computer Name Disk Size 54" 34"  Product(s) (Not Copy Protected) 54" 34"  Power C compiler (\$19.95) \$ 50"  Power Ctrace debugger (\$19.95) \$ 50"  Library Source Code (\$10.00) \$ 50"  (includes assembler & library manager) BCD Business Math (\$10.00) \$ 50"  Add Shipping (\$5 USA - \$20 Foreign) \$ 50"  Texas Residents add 8% Sales Tax \$ 50"  Power C & Power Ctrace are trademarks of Mix Software Inc.  Power C & Bower Ctrace are trademarks of Mix Software Inc.	Card #			
Product(s) (Not Copy Protected)  Power C compiler (\$19.95) \$   Power Ctrace debugger (\$19.95) \$   Library Source Code (\$10.00) \$   (includes assembler & library manager)  BCD Business Math (\$10.00) \$   Add Shipping (\$5 USA - \$20 Foreign) \$   Texas Residents add 8% Sales Tax \$   Total amount of your order \$   Power C & Power Ctrace are trademarks of Mic Software Inc. Quick C & Codeview are registered trademarks of Microsoft Corp	Card Expirati	on Date	Dist. Ois	
Product(s) (Not Copy Protected)  Power C compiler (\$19.95) \$  Power Ctrace debugger (\$19.95) \$  Library Source Code (\$10.00) \$  (includes assembler & library manager) BCD Business Math (\$10.00) \$  Add Shipping (\$5 USA - \$20 Foreign) \$  Texas Residents add 8% Sales Tax \$  Total amount of your order \$  Power C & Power Ctrace are trademarks of Microsoft Copp	Computer N	ame	DISK SIZ	B [] 016"
Power C compiler (\$19.95) \$	Product(s) (	Not Conv Pro	tected)	1 PAS
Power Ctrace debugger (\$19.95) \$   Library Source Code (\$10.00) \$   (includes assembler & library manager)   BCD Business Math (\$10.00) \$   Add Shipping (\$5 USA − \$20 Foreign) \$   Texas Residents add 8% Sales Tax \$   Total amount of your order   Power C & Power Ctrace are trademarks of Microsoft Corp.	Dower .	c compiler	(\$19.95)	5
Library Source Code (\$10.00) \$  (includes assembler & library manager)  BCD Business Math (\$10.00) \$  Add Shipping (\$5 USA - \$20 Foreign) \$  Texas Residents add 8% Sales Tax \$  Total amount of your order \$  Power C & Power Ctrace are trademarks of Mix Software Inc. Quick C & Codeview are registered trademarks of Microsoft Corp	Power	Ctrace debu	gger (\$19.95)	8
BCD Business Math (\$10.00) \$ Add Shipping (\$5 USA - \$20 Foreign) \$ Texas Residents add 8% Sales Tax \$ Total amount of your order Power C & Power Cirace are trademarks of Mix Software Inc. Quick C & Codeview are registered trademarks of Microsoft Corp	Library	Source Cod	ie (\$10.00)	\$
Add Shipping (\$5 USA - \$20 Foreign) Texas Residents add 8% Sales Tax Total amount of your order  Power C & Power Cirace are trademarks of Mix Software Inc. Quick C & Cadeview are registered trademarks of Microsoft Corp				
Texas Residents add 8% Sales Tax Total amount of your order Power C & Power Cirace are trademarks of Mix Software Inc. Quick C & Codeview are registered trademarks of Microsoft Corp.				5
Total amount of your order  Power C & Power Ctrace are trademarks of Mix Software Inc. Quick C & Codeview are registered trademarks of Microsoft Corp.	Add Shippin	g (\$5 USA -	Sales Tay	9-
Power C & Power Ctrace are trademarks of Mix Software Inc. Quick C & Codeview are registered trademarks of Microsoft Corp.				8
Quick C & Codeview are registered trademarks of Microsoft Corp.				oftware Inc.
	Quick C & C	odeview are regis	stered trademarks of N	ticrosoft Corp.

Circle 203 on Reader Service Card

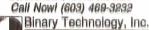




The \$595 Solution to 8051 Product Davelopment

The PDK51 is a powerful and economical choice for the development of 8051-based systems. The PDK51 is used with an IBM-PC or equivalent and includes:

- SIBEC-II 8052 Basic Microcontroller SXA51 Cross Assembler FIOM-Based Monitor/Debugger PROM Programmer Power Supplies Documentation, Tutorial and More



Main St., P.O. Box 67, Meriden, NH 03770

DATAFLEXIM

- Multi-user Databasel
- Powerfull
- Multiple Operating System Compatibility!
- Attractive Dealer Pricingl
- Full Dealer Support! Dataflex is a trademark of Data Access Dealer Inquiries Invited



24000 Telegraph Road Southfield, Michigan 48034 USA (313) 352-2345

Circle \$5 on Reader Service Card



Circle \$8 on Reader Service Card

(800) ACT ON IT

## CHIPCLOC

CompuCom Corporation

(408) 732-4500 (GA)

10-year clock/calendar IN A CHIP!

Easy plug-in ■ 10-year battery Never set date/time again No slet needed ■ 100% compatible

NOW WORKS WITH PS/2

CHIPCLOK w/software NOW \$49.00

30-day money-back guarantee

#### COMPUQUEST INC.

801 Morse Ave. M Schaumburg, IL 60193

1-800-722-2353 1-312-529-2552 in IL

Circle 59 on Reader Service Card



· High Resolution Circles: Suitable for PCB Artwork

(415) 490-8380 ZERICON STEVENSON BUSINESS FARK BOX 1669, FREMONT, CA 94538

#### HANDS ON

#### SOME ASSEMBLY REQUIRED

(FPSUB) and checking the sign of the result.

Of course, there are other routines that are even simpler. To take the absolute value of a floating-point number, you simply clear the sign bit. To change a floating-point number's sign, you do an exclusive-OR operation on the sign bit. You can perform these functions without even moving the number into the accumulator.

Then there are the tough routines, such as trigonometric and transcendental functions. You can handle these by applying either interpolation to lookup tables (if you have lots of storage and you're looking for speed) or series expansion (which is best when storage is tight and you don't mind waiting a little for your answer). For example, the series expansion for sine(x) is as follows:

sine(x) = 
$$x - x^3/3! + x^5/5! - x^7/7! + x^9/9! \dots$$

The infamous CRC (Chemical Rubber Company) Handbook of Standard Mathematical Tables, forever the sidekick of any university math, science, or engineering student and available in most college bookstores, will provide you with the series expansion for more functions than you can think of.

Finally, you can find more information on floating-point processing in the In Depth section of the March Issue of BYTE.

#### Next Month

Dave Betz, author of XLISP, joins in for a discussion of embedded languages.

#### BIBLIOGRAPHY

Feierback, Gary, and Paul Thomas. Forth Tools and Applications. Reston, VA: Reston Publishing, 1985.

Findley, Robert. Scelbi '8080' Software Gourmet Guide and Cook Book. Milford, CT: Scelbi Computer Consulting,

Graham, Neill. Microprocessor Programming for Computer Hobbyists. Blue Ridge Summit, PA: Tab Books, 1977.

Rick Grehan is a BYTE senior technical editor at large. He has a BS in physics and applied mathematics and an MS in computer science/mathematics from Memphis State University. He can be reached on BIX as "rick\_g,"

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH, 03458.

Circle 283 on Reader Service Card



Stop fooling around. It's time to get hardcore about software. With Microsoft.

We'll give you all the resources you want. Tens of millions in R&D funding. Along with one of the most elementary tools for thinking — a door, which leads to your own private office. All backed by management that truly does speak your language, because they probably helped write it.

We're serious about software design. If you are too, then apply right now for one of these opportunities.

### **Software Design Engineers**

We're working on everything from worldclass application software, compilers, operating systems, and networking to sophisticated graphics, powerful productivity software and more. You could be too, if you have programming experience and a background that includes 68000, Macintosh® Toolbox, Windows "C", micro's, 8086, UNIX MENIX®, or MS-DOS®.

There are opportunities to work with our teams in systems, applications, CD-ROM, languages, or networking.

If you qualify, Microsoft offers you an opportunity to live and work where the quality of life is high and the cost of living is low — the beautiful Pacific Northwest. Along with amenities such as a health club membership, workout facilities and parcourse, plus an array of benefits.

To apply, please send your resume in confidence to: MICROSOFT CORPORATION, Human Resources, Dept. SSDE-1088BYTE, 16011 N.E. 36th Way, Box 97017, Redmond, WA 98073-9717. We are an equal opportunity employer. No phone calls, please.



#### A Directory of Products and Services

THE BUYER'S MART is a monthly advertising section which enables readers to easily locate suppliers by product category. As a unique feature, each BUYER'S MART ad includes a Reader Service number to assist interested readers in requesting information from participating advertisers.

RATES: 1x-\$475 3x-\$450 6x-\$425 12x-\$375 Prepayment must accompany each insertion. VISA/MC Accepted.

AD FORMAT: Each ad will be designed and typeset by BYTE. Advertisers must

furnish typewritten copy. Ads can include headline (23 characters maximum), descriptive text (250 characters is recommended, but up to 350 characters can be accomodated), plus company name, address and telephone number. Do not send logos or camera-ready artwork.

DEADLINE: Ad copy is due approximately 2 months prior to issue date. For example: November issue closes on September 9. Send your copy and payment to THE BUYER'S MART, BYTE Magazine, 1 Phoenix Mill Lane, Peterborough, NH 03458. For more information call Mark Stone at BYTE 603-924-3754.

#### **ACCESSORIES**

#### FREE CATALOG

Thousands of parts and new surplus electronic parts at super low prices. FAST ORDER PROCESSING AND SHIPPING (95% of all orders shipped within

CALL OR WRITE FOR A FREE CATALOG.

**ALL ELECTRONICS CORPORATION** P.O. Box 567, Van Nuys, CA 91408-0567

1-800-826-5432

Inquiry 576.

#### **ACCESSORIES**

#### YOUR OWN COMPUTER PAPER

Put your name and/or department, project, proposal, or report across the bottom of every final presentation page. Send us your copy plus name, address, phone number and printer make and model number and we'll send you

## FORMSMART, INC P.O. Box 592, E. Freetown, MA 02717

Inquiry 581.

#### a 64K Lisp program, which will run on a MAC plus or equivalent. 1MB RAM recommended for this program. Send order to:

ARTIFICIAL INTELLIGENCE

LISP on a MAC

Get all the functionality of the Franzlisp

dialect of the Lisp language. \$20 purchases

**Oosson Software** Box 33113, Coon Rapids, MN 55433

Inquiry 585.

#### FREE UPS CATALOG

Protect your computer and make it last longer.
Call or write today!

### Best Power Technology, Inc.

World's largest manufacturer of uninterrruptible power systems.

P.O. Box 280, Necedah, WI 54646 TOLL FREE (800) 356-5794 ext. 1004 or (608) 565-7200 ext. 1004

**CUT RIBBON COSTS!** 

**BORG INDUSTRIES** 

525 MAIN ST., JANESVILLE, IA 50647

Inquiry 577.

1-800-553-2404 Inquiry 578.

#### SMART PRINTER STAND

UNDERSTAND

is an attractive printer stand with switchable data conversion, surge suppression & power switch. Saves space & avoids clutter! UNDERSTAND-PP:

\$295 (2 parallel in, 1 parallel out) UNDERSTAND-PS: \$395 (1 parallel & 1 serial in, 1 parallel out)

MAS Inc. 15941 S. Harlem Ave., Suite 333, Tinley Park, IL 60477 (815) 469-4501

#### Inquiry 582.

ARTIFICIAL INTELLIGENCE

#### HIGH PERFORMANCE RULES BASED EXPERT SYSTEM "SHELL" (H.E.S.).

CAPERI SYSIEM "RILES, Locates for thousands and thousands of rules, integrate with your existing database. Easy to use, no knowledge of programming required. Applications: medical diagnosis, fault diagnosise, business, admin. banking, finance, insurance, law, engineering, education, electricity boards and many other application areas. Available on PC/KTAT, MS-DOS, Xenix, Unix. Demo copy \$84 (with facility to create 300 rules). Full version \$21,000.

#### HORIZON SOFTWARE LTD.

27 East St., Leicester LE1 6N Tel (44) 533 556550

Inquiry 583.

#### muLISP™ 87 for MS-DOS

Fast, compact, efficient LISP programming environment. muLISP programs run 2 to 3 times faster & take ½ to ½ the space of other LISPs. 450 Common LISP functions, multi-window editing & debugging, flavors, graphics primitives, lessons & help, demo programs, comprehensive manual.

Soft Warehouse, Inc. 5 Harding Ave., Suite 505, Honolulu, HI 96816 3615 Harding Ave., Suite 505, (808) 734-5801

Inquiry 586.

#### **BACK UP SYSTEMS**

HD BAC-UP
THE EASIEST & FASTEST BACKUP UTILITY FOR PC/XT/ATS & COMPATIBLES. AFFORDABLE PRICE \$36.50. EASY INSTALLATION & USE — REQUIRES
NO KNOWLEDGE OF DOS — DAILY BACKUPS RUN
IN A FRACTION OF THE TIME.
CALL FOR INFO & DEMO DISK 800-457-1313.

#### **HI-TEC INDUSTRIES**

6100 S. Fairfax Rd., Bloomington, IN 47401 812-824-8000

Inquiry 587.

## SELF-INKING PRINTER RIBBON

In IOWA 319-987-2976

Awarded United States Patent #4701062
Lasts 10-15 times longer than the conventional ribbor
For printers using ½" width open spool ribbon:

Okidata-82A-83A-84-92-93 Dec LA 180/120
Teletype-33, 35 Dec LA 30/IBM 1443
Star Gemini 10X Teletype-Model 40
Extel Til 800/810, 820, 880
Contact us by mail, phone or telex and we will florward you a brochure.

CONTROLLED PRINTOUT DEVICES, INC. (704) 684-9044 • TELEX: (FILMON-AREN) 577454

Inquiry 579.

#### **NanoLISP** \$99.99

An MS-DOS Common LISP interpreter that supports most Common LISP operations and strictly adheres to the standard. Numerous advanced and extra features, excellent debugging facilities, sample Al programs, fully-indexed manual, free technical support.

Microcomputer Systems Consultants P.O. Box 6646, Santa Barbara, CA 93160

(805) 967-2270

#### BAR CODE

#### **BAR CODES & BIG TEXT**

On EPSON, IBM, OKI dot matrix or LaserJet, Design any for-mat/size on ONE easy screen. 1-120 fields/label. 13 text sizes to 1" — readable at 50 ft. AIAG, MIL-STD, 2 of 5, 128, UPC/EAN, Code 39, etc. Color, Reverses, File Input, FAST—S279. Other menu-driven bar code programs from \$49.

#### **Worthington Data Solutions**

417-A Ingalls St., Santa Cruz, CA 95060 (800) 345-4220 In CA: (408) 458-9938

#### Companion and Extender

The PS/2 COMPANION lets you add an extra keyboard and monitor up to 150 feet away from your system unit. It comes complete with all connections and supports both color and monochrome monitors. Prices start at \$249 for a 25' unit. EXTENDER lets you move the keyboard and monitor up to 150 feet from the system unit. Prices start at \$149.

#### **Cybex Corporation**

2800-H Bob Wallace Ave. Huntsville, AL 35805 205-534-0011

Inquiry 580.

#### **NEW Expert System**

FirstExpert - expert system generator. Ridiculously easy yet extremely powerful. No programming needed. Speed up business decisions and analysis. Information transferable to other environments. Amplifies Your intelligencel An ingenious program for a sensational price. Many examples included.

\$99 Call or write for more information.

**NovaCast Expert Systems** 2530 Berryessa Rd. Suite 607, San Jose, CA 95030 (408) 272-4071 fax: (408) 437-7777

Inquiry 584.

#### **BAR CODE READERS**

From the manufacturer for PC/XT/AT, & PS/2. Attaches as 2nd keyboard, reads as keyed data. External or bus install. With steel wand—\$399. Also Kimtron, Link, Wyse, & RS-232. Portables, Lasers, slot badge readers, and MagStripe too!

30 day \$ back.

#### **Worthington Data Solutions** 417-A Ingalls St., Santa Cruz, CA 95060

(800) 345-4220 In CA: (408) 458-9938

#### **BAR CODES**

#### PRINT BAR CODES/BIG TEXT FROM YOUR PROGRAM

Add bar codes and big graphics text to your program. Print from ANY MS-DOS language. Bar codes: UPC, EAN, 2 of 5, MSI, Code 39. Epson, Oki, IBM dot matrix text up to ½". LaserJet up to 2". Font cartridges not required. \$159—\$239. 30 day \$\$ back.

Worthington Data Solutions

417-A Ingalis St., Santa Cruz, CA 95060 (800) 345-4220 In CA: (408) 458-9938

#### **COMPLETE LINE** OF BAR CODE PRODUCTS

- PrintBar II PrintBar Softfonts
- PrintBar I CodeScan 2000

FREE BROCHURES (206) 451-8966

Bear Rock Software Co. 6069 Enterprise Dr. Placerville, CA 95667

#### BAR CODE MADE EASY

PERCON® E-Z-READER™ keyboard interfaces and multiuser RS-232 models make it easy to add bar code to virtually any HS-232 models make it easy to add bat cloud or winday any computer/terminal WITHOUT SOFTWARE MODIFICATION. Immediate shipping. Two year warranty. Bar code printing software available. Call for details on fast, accurate, easy data entry. Substantial reseller discounts.

#### PERCON®

2190 W. 11th St., Eugene, OR 97402

(503) 344-1189

#### **READ & PRINT BAR CODES**

Fast, reliable data entry into your programs as if from your keyboard. Internal unit for PC, XT, AT PS/2-M30. RS-232 unit for DOS & Non-DOS systems (incl. all PS/2). Stainless steel wand and LASER interfaces. Powerful Bar Code and Text printing software.

Seagull Scientific Systems
15127 N.E. 24th, Ste. 333, Redmond, WA 98052

(206) 451-8966

#### BAR CODE READERS

Among the industries best and most widely used barcode reader, reads all major barcode formats (code 39, 2 of 5, UPC/EAN, codabar), connects between keyboard & system, advanced CMOS uses keyboard power supply, connects to all IBM compatibles and DIN terminals, completely OS independent, software independent. Same day ship, 1 year warranty, 30 day satisfaction guarantee. CALL for prices too low to

**Solutions Engineering Sales** 

8653 Georgia Ave., Silver Spring, MD 20910

800-635-6533

Inquiry 588.

#### DATA INPUT DEVICES

Bar Code & Magnetic Stripe Readers for microcom-puters & terminals, including IBM PS/2 & others, DEC, AT&T, CT, Wyse, Wang. All readers connect on the keyboard cable & are transparent to all software. Low cost bar code print programs & magnetic encoders are also available. GSA contract #GS00K87AGS5346.

#### **TPS Electronics**

4047 Transport, Palo Alto, CA 94303 415-856-6833 Telex 371-9097 TPS PLA

Inquiry 589.

#### **BBS PUBLIC DOMAIN**

## 7,500 + Titles in Download Library

18+ Special Interest Forum message bases plus Real Time Conferencing. USA TODAY Decision-Line News Service. Quarterly Newsletter & BBS System Users Guide. PC Pursuit Accessible. Fee: \$10/3 Mo. — \$25/Yr.

9 Incoming lines. FREE DEMO MODE (503) 761-8100 12/2400 N,8,1

**RANDOM ACCESS Information Network** 

P.O. Box 16675, Portland OR 97216 Voice: (503) 239-8299

Inquiry 590.

#### CAD/CAM

#### \$39.95 CAD

Fully featured, symbols, auto dimensioning, hatching, fillets, reads DXF, handles all but the largest drawings. Extremely powerful BASIC-like macros, on line manual plus so much more. Requires IBM XT/AT/PS2 with 640K and hard disk. 20,000 new users this year

#### PAFEC INC.

5550 Technology Park, Norcross, GA 30092 (404) 441-9300 1-800-52PAFEC

Inquiry 591.

#### CASE

#### Affordable CASE

A new concept in Computer Aided Engineering for developing PC/DOS applications! C Dispatcher generates fast, efficient C code for command and menu driven applications. Develop, document, and change easily. Many features. For many compilers. \$295.00 MC/Visa

Amaryllis Inc.

quadoc Rd., Bolton, MA 01740 (617) 365-5456

Inquiry 592.

#### CASE STATE PROGRAM COMPILERS

The COMPEDITOR, a software development tool quickly documents and forms real time and event driven source programs in ADA, BASIC, C, FORTRAN and PASCAL.

190K RAM Dos 2.0+ IBM PC. XT. AT. PS/2 Price: \$175.00 per language (With Primer and Debugger) Sampler \$30

**AYECO** 5025 Nassau Circle, Orlando INCORPORATED FL 32808 (407) 295-0930

Inquiry 593.

#### PROTOTYPING TOOL

Build a working system model of your application with PC-PROTO. Very Fast. Very Flexible. No Programming Required. Screen Painter. Data Base Manager. Generate data dictionary, source code, documentation, programming specifications. Suitable for JAD as well. For PC, XT or AT. From MC/VISA.

Kartech, Inc. (416) 656-2032 165 Pinewood Ave., Toronto, Ontario, Canada M6C 2V6

Inquiry 594.

#### CD/ROM

- Public Data on CD-ROMs Econ/Stats I — Prices, Employment
  Consu/Stats — BLS/Census 1984 consumer data
- Agri/Stats Agricultural series
  Makes tables, DIF, or ASCII
  \$49 each, req. MS-DOS

- CD-ROM publishing services available

## Hopkins Technology 421 Hazel Lane, Hopkins, MN 55343 2) 931-9376 Compuserve 74017,614

(612) 931-9376

Inquiry 595.

#### COMMUNICATIONS

#### Bi-Directional File X-fers

Multiplex Systems (412) 276-3374 24 hrs.

P.O. Box 16174, Pittsburgh, PA 15242

Inquiry 596.

#### **FAX MACHINES \$395**

MURATA FAX 1200/1600	\$795/925
SHARP FAX FO300/FO500	\$1195/1495
TOSHIBA FAX 30100/3300/3700\$1088/	1240/CALL
RICOH 10/20	\$1295/1595
CANON FAX 20	\$1279
PC/XT SYS.Receive/Transmit FAX+Scanner	\$1595
PC/XT Telephone Answer & Voicemail	\$1195
Prepay prices Visa/MC 2% cod 2% restor	k 20%

TELEPHONE PRODUCTS CENTER 23591 #213 El Toro Rd., El Toro, CA 92630 714/739-9555

Inquiry 597.

#### **COMPUTER INSURANCE**

#### INSURES YOUR COMPUTER

SAFEWARE provides full replacement of hardware, media and purchased software. As little as \$39 a year provides comprehensive coverage. Blanket coverage; no list of equipment needed. One call does it all. Call 8 am-10 pm ET. (Sat. 9 to 5)

#### TOLL FREE 1-800-848-3469

(Local 614-262-0559)

SAFEWARE, The Insurance Agency Inc.

Inquiry 598.

#### **COMPUTER RENTALS**

#### NTAL E

WEEKLY MONTHLY YEARLY

IBM - APPLE

COMPAQ 189 Full Free PER MO. Full Stock/Next Day Delivery Free Service & Maintenance

800 PC-RENTL IBM PS/2 Model 50

Inquiry 599.

#### **CROSS ASSEMBLERS**

#### **CROSS ASSEMBLERS**

Universal Linker, Librarian Targets for 36 Microprocessors Hosts: PC/MS DOS, micro VAX, VAX 8000 Developed and supported at:

ENERTEC, INC.

BOX 1312, Lansdale, PA 19446 215-362-0966 MC/VISA

Inquiry 600.

#### **Professional Series**

PseudoCode releases it's PseudoSam Professional Series of cross assemblers. Most popular processors. Macros, Conditional Assembly, and Include Files. Vir-tually unlimited size. For IBM PC's, MS-DOS 20 or greater. With manual for \$35.00. Each additional \$20.00. (MI res. 494 tax). Shipping \$5, Canada \$10, Foreign \$15. Visa/MC. (Dealer Inquiries Welcome).

#### Kore

6910 Patterson, Caledonia, MI 49316

616-791-9333

Inquiry 601.

#### **CROSS ASSEMBLERS**

#### **FANTASTIC SIMULATORS**

For the 8048, 8051, 8080, 8085, & Z80 families. Full function simulation including ALL MODES of interrupts. Built-in disassembler. Better than expensive I.C.E.'s.

#### **CROSS ASSEMBLERS**

We support the 8048, 8051, 8080/8085, 8096 & Z80 families.

#### **Lear Com Company**

2440 Kipling St./Ste. 206, Lakewood, CO 80215 303-232-2226

Inquiry 602.

#### **CROSS ASSEMBLERS**

Macros, PC Compatible, Relocatable, Conditionals, Fast, Reliable . . . . . . from \$150 also: Disassemblers **EPROM Programmer Board** 

#### MICROCOMPUTER TOOLS CO.

Phone (800) 443-0779 In CA (415) 825-4200 912 Hastings Dr., Concord, CA 94518

Inquiry 603.

#### 680X0 Cross Assemblers

Now, Inexpensive quality 6/80% Cross Assemblent hat use your IBM PC or compatible All versions include entensive listing facilities, up to 32 char labels, sorted symbol tables, INCLUDE files, PATH names, ORG, DC, DS, EDU, other directives (except MACROS), printed manuals. Basic versions create 5-records. Linking versions create 5-records or binary output files. Not copy protected. Minimum requirements are 200K, DOS 2XV, 8.154" DSDD.

Basic 680006801—54995 Linking 68000/68010—58995
Basic 680028-59935 Basic 6800288881—5129
Checks, VISA, MC accepted, MN residents +696 sales tax. No PO's or COO's, please.

**RAVEN Computer Systems** 

Box 12116, St. Paul, MN 55112 (612) 636-0365

Inquiry 604.

#### **ASSEMBLERS & TRANSLATORS**

Over 20 high quality, full function, fast relocatable and absolute macro assemblers are available immediately. Source language translators help you change microcomputers. Hosts: MS/DOS, CPM80, ISIS.

#### RELMS™

P.O. Box 6719, San Jose, CA 95150 (408) 356-1210 TWX 910-379-0014 MC/VISA AMEX

Inquiry 605.

#### Z80/HD64180

SLR Systems cross assemblers run on PC and are compatible with Microsoft M80/L80. \$195.00 for assembler and linker. We have CP/M emulator cards for PC. Up to 12.5 mhz Z80 clock speed, starting at \$249.95! Also Z80/HD64180 C compilers.

#### **Z-World**

1772 Picasso Ave., Davis, CA 95616 (916) 753-3722

Please see our ads on page 320.

Inquiry 606.

#### DATA CONVERSION

#### MEDIA CONVERSION/DATA TRANSLATION

More than just a straight dump or ASCII transfer!
Word Processing, DBMS, and Spreadsheet data on Disks
or Tapes transferred directly into applications running on
Mainframes, Minis, Micros, Dedicated Word Processors,
Typesetters, and Electronic Publishing systems,
IBM PSI/2 & Macintosh supported
#1 in the translation industry!

#### CompuData Translators, Inc. 3325 Wilshire Blvd., Suite 1202, Los Angeles, CA 90010

(213) 387-4477 1-800-825-8251

Inquiry 607. 302 BYTE • OCTOBER 1988

#### **DATA CONVERSION**

#### PEP Your Data to MS-DOS!

PEP ("Printer Emulation Package") is a unique software product which makes your MS-DOS system appear to product which makes your MS-DOS system appear to be an intelligent serial printer. Converting your data from another operating system is as easy as printing it! Diskette plus 90 page typeset manual, \$64.95 U.S. (Not copy protected.) Specify 5½ or 3½ inch diskette size; add \$5 for both formats.

Intelpro
13 Saratoga Dr., Kirkland, Quebec, Canada H9H 3J9

(514) 694-6862

Inquiry 608.

#### DATABASE MGMT. SYSTEMS

#### SOFTWARE KIT PACKAGING

OEM supplier to one of the world's largest computer companies offers quality packaging and supplies for your software products. From diskettes to printed manuals. Quality products reflecting your company's image is our highest priority. Call or write.

#### COMPUTER LOGICS LIMITED

(716) 633-2810

4845 Transit Road Unit K-8, Depew, NY 14043 Fax (716) 633-2813

Inquiry 609.

#### FREE TRIAL dBASE III CLO!!

"1 on 1 is a programmable relational DBMS...1 on 1 = 3!! is a great deal for those who would be glad to have a dBASE III PLUS clone"

dBASE III PLUS clone"

\*\* PC MAGAZINE 5/17/88 \*\*
Free 30 day trial full program USA only or Buy now get free
upgrade. Money black guarantee \$69 + \$5. \$5/H chk/Amex.
CAN +\$4. Other +\$50. Call or write:

#### 1 on 1 Computer Solutions

26 Finchwood Dr., Trumbull, CT 06611 203-375-0914 dBASE III is a trademark of Ashton-TATE

Inquiry 610.

#### DATA/DISK CONVERSION

#### **QUALITY CONVERSIONS**

· Disk • Tape • Scanning

\*TYPEWRITTEN \$.33 per page to ASCII \*TYPESET 6-24 point Low Rates (\*WP Formats available) IMAGES Logos/Line Art/Glossies

1st Run Computer Services Inc. 1261 Broadway, Suite 508, New York, NY 10001 (212) 779-0800

Inquiry 611.

#### Get the Expertise You Need!

Disk/Disk • Tape/Disk • OCR

Over 1,000 formats! 31/2, 51/4, or 8 inch disks; 9 track mag tape; 10 MB Bernoulli cartridge. Data base and word processor translation. Specialists in Government Security Data. Call for free consultation

#### Computer Conversions, Inc.

9580 Black Mtn. Rd., Ste J, San Diego, CA 92126

(619) 693-1697

Inquiry 612.

#### **DISK CONVERSIONS**

Media transfer to or from: IBM, Xerox, DEC, Wang, Lanier, CPT, Micom, NBI, CT, also WP, WS, MS/WRD, DW3, MM, Samna, DEC DX, MAS 11, Xerox-Writer, ASCII.

#### FREE TEST CONVERSION CONVERSION SPECIALISTS

531 Main St., Ste. 835, El Segundo, CA 90245 (213) 545-6551 (213) 322-6319

Inquiry 613.

#### **DATA/DISK CONVERSION**

#### **DISK & TAPE CONVERSIONS** AUTOMATICALLY

SAVE TIME AND MONEY
Over 1000 formats from Mini, Micro Mainframe, W
cessors, & Typesetters.

TAPE Conversions as low as \$23.00 MB DISK Conversions as low as \$15.00 per Disk Call or write TODAY for a cost saving quotation

#### **CREATIVE DATA SERVICES**

1210 W. Latimer Ave., Campbell, CA 95008 (408) 866-6080

Inquiry 614.

#### **RUN HP SERIES 80** PROGRAMS ON IBM PC

Translator allows users to move programs written on HP 85, 86, 87, 9915 to IBM PC, AT, PS/2, compatibles and run them on Microsoft's powerful QuickBASIC 4.0. File copy utility included. HP BASIC program translation and disk file copy to PC's our specialty. Call us.

Oswego Software 507 North Adams St. Oswego, Illinois 60543

312/554-3567 FAX 312/554-3575 **TELEX 858757** 

#### **CONVERSION SERVICES**

Convert any 9 track magnetic tape to or from over 1000 formats including 31/2", 51/4", 8" disk formats & word processors. Disk to disk conversions also available. Call for more info. Introducing OCR Scanning Services

### Pivar Computing Services, Inc.

165 Arlington Hgts. Rd., Dept. #B Buffalo Grove, IL 60089 (312) 459-6010

Inquiry 616.

#### **DEMOS/TUTORIALS**

### **INSTANT REPLAY III**

Build Demos, Tutorials, Prototypes, Presentations, Music, Timed Keyboard Macros, and Menu Systems. Includes Screen Maker, Keystroke/Time Editor, Program Memorizer, and Animator. Recid Great Reviews! Simply the BEST. Not copy protected. No royalties. 60 day satisfaction money back guar. IBM and Compatb. \$149.95 U.S.Chk/Cr. Crd. Demo Diskette \$5.00

#### NOSTRADAMUS, INC.

3191 South Valley Street (ste 252)
Salt Lake City, Utah 84109 (801) 487-9662

Inquiry 617.

#### **DESKTOP PUBLISHING**

#### HIGH RESOLUTION MONITOR

- Desktop Publishing and CAD low cost graphics subsystem
   Workstation Resolution for your IBM PC/XT or AT compatible
   1024 x 788 paper white 14" flat screen
   Drivers for Ventura, Page Maker, Windows, GEM and AutoCAD
   Can coexist with another color graphics adapter
   Call NOW \$595 including graphics board, monitor and
   software

- VISA and MasterCard accepted

CATI INC

16840-B Joleen Way, Morgan Hill, CA 95037 HOT LINE 408-778-CATS

Inquiry 618.

#### Desktop Publishers!

When you need the best "no-nonsense" tools for Screen Capture and Image Management

### Collage Display Utilities Dynamic Grayscaling, Image Browsing and Cataloging, and much, much more! Supports EGA, VGA, PS/2, CGA, Hercules, and MDA displays!

Suggested Retail price, only \$8995

Inner Media, Inc. (603) 465-3216, -7195 Fax

Inquiry 619.

#### DISK COMPATIBILITY

#### IBM PC's USE Mac DISKS

MatchMaker lets you plug any Macintosh exter-nal floppy drive into an IBM PC. Half size card and software lets you copy to/from, view directory, in-titalize, or delete files on the Mac diskette. Works with PCs, XTs, ATs, and compatibles. The easy way to move information/ \$149.00 Visa/MC/COD/Chk

Micro Sciutions Computer Products 815/756-3411

Inquiry 620.

#### DISK DRIVES

	HARD	DISKS	
MN6128	110 MB	SWBS	\$699.
MN9380E	338 MB	16M8	\$2388.
MNGOBS	71 MB	28M8	\$545.
MQ1355	150 MB	BMES	\$1299.
MO1335	71 MB	28M8	\$545.
874098	80 MB	SAMS	\$525.
8T251	40 MB	40M8	\$329.
ST251-1	40 MB	SWBS	\$379.
CPU	INC	(714)	870-9033

Inquiry 621.

#### PS/2 DRIVES FOR PC's AT's

CompatiKit/PC		٠								,		\$329
CompatiKit/AT .	*			 ,	٠		9		,	6	٠	\$269

Built-in floppy controllers—no problem.
Supports multiple drives and formats. Lets your computer use IBM PS/2 1.4M diskettes plus more!
Call for further information or to place an order.
VISAMOCOLVCHECK.

Miero Sciutions Computer Products 132 W. Lincoln Hwy., DeKalb, IL 60115 815/756-341

Inquiry 622

#### DISK DUPE EQUIPMENT

### DO YOUR OWN DUPLICATION

Copy 10,000 or only 10 . . . . in as little as 15 seconds each with famous Mountain Duplication equipment at the very best prices!! See us for all of your duplication equipment needs from Disks to Drives to Duplicators.

#### SYSTEMS SUPPORT DATA

223 North Royal Avenue, Front Royal, VA 22630 1-800-231-4355

Inquiry 623

#### DISK DUPLICATION

### **DUPLICATION IS THE SINCEREST FORM OF FLATTERY**

Let us Flatter you'll See us for all disk duplication needs. 10 disks to 100,000 and more All formats-All systems. Best prices-Our own in-house printing of documentation-labels-sleeves

### STEMS SUPPORT DATA

223 North Royal Avenue, Front Royal, VA 22630 1-800-231-4355

Inquiry 624

#### DISKETTES

### CHEAP DISKS!!!

Although this headline may not convey quality....our 31/2" floppy disks dol 100% Certified

720k only 98¢ 1.44 MEG only \$2.60 SYSTEMS SUPPORT DATA

223 North Royal Avenue, Front Royal, VA 22630

1-800-231-4355

Inquiry 625.

#### **DUPLICATION SERVICE**

#### SOFTWARE DUPLICATION

- One Stop Shopping Technical Support
   Custom Packaging Drop Shipping
   Copy Protection Fast Turnaround
   Competitive Pricing

#### SATISFACTION GUARANTEED 800-222-0490 NJ 201-462-7628

MEGASoft

PO. Box 710. Freehold, NJ 07728

See our ade on page 339

inquiry 626.

#### SOFTWARE PRODUCTION

- Disk duplication
- All formats · EVERLOCK copy
- protection Label/sleave printing
- Full packaging
- Consultation & guidance

WarehousingDrop shipping

Fulfillment
48-hour delivery

sarvicas Star-Byte, Inc. 713 W Main St., Lansdale, PA 19446 800-243-1515

215-368-1200 Inquiry 627.

#### ENTERTAINMENT

#### \* \* CHESS SPECTACULARI \* \*

At lest a chess program designed for the new graphics standard. High resolution animation brings your EGA to life! Solves male in 7. Huge opening book. Save/restar your games. Animated teaching mode. Select level. Take back/Change sides. On screen clock. MUCH MORE! EGA Chess \$68.95 256k EGA/VGA 5.25" diek. VISA/MO

CUBE Microsystems PO. Box 26084, Overland Park, K8 88226

(913) 649-6747

Inquiry 628

#### HOOKED ON BLACKJACK?

Blackjack Players— Improve your play with an insepensive but good (IBQ) Blackjack program. Plays ALL Casino games and options. Blackjack vi ob includes: on riles basic strategies \* simple card counts. For your card-counties there is a Pro-Player Ungrade feature that allows YOUR card counts and YOUR strategies which have countied to the program of th

IBQ SOFTWARE

P.O. Box 276354, Dept. B, Boos Haton, FL 334276354

Inquiry 629.

NEMESIS<sup>TM</sup> Go Master<sup>TM</sup>
Go is a popular Oriental game of intellectual complexity and elegance. NEMESIS, recognized worldwide as the best Go program, is an ideal playmate and tutor. Pournelle's game of the month twice: "If you are interested in Go, buy this program," BYTE 7/87

Toyogo, Inc.

76 Bedford St., Ste. 34Y, Lexington, MA 02173 (617) 861-0488

Inquiry 630.

#### FLOW CHARTS

FLOW CHARTING II + HELPS YOUI Precise flowcharting is fast and simple with Flow Charting II + Draw, edit and print perfect charts: bold and normal lonts. 26 shapes — 95 sizes; fast entry of arrows, bypasses & con-nectors; Fast Insert Line; shrink acreen displays 200-column chart; 40 column edit screen for detail work, much moret

#### PATTON & PATTON

1-800-525-0082 (Outside CA) 408-629-5378 (CA/Int'l)

Inquiry 631.

#### FLOW CHARTS

#### STRUCTURED FLOW CHART

NSChart creates Nassi-Shneiderman (structured) flowcharts from a simple PDL. Keywords define structures & text strings appear in the chart. Easy to create, even easier to revisel Automatic chart sizing, text centering. Translators from many languages available. For Mac and IBM PC.

SILTRONIX, INC. PO. Box 82544, San Diego, OA 92138

1-800-637-4888

inquiry 632.

#### HARDWARE

#### **8096 Microcontroller**

Single Board 8098/7, Ser. Interface, 5V only; Assembler+Forth in EPROM+Manual/Bottware Guide \$400. Add-on EPROM Simulator Incl. download S/W \$350. Hardware/Software evaluation package incl. cabling and lutorial books \$580. Oross Compiler (Assembler/Forth) available.

DIGITAL MICRO CONTROL 15617-26th Drive S.E., Mill Creek, WA 98012 (206) 338-2406

Inquiry 633.

#### CHIP CHECKER

- 74/54 TTL + CMOS 8000 Nat. + Signetics 14/4000 CMOS 9000 TTL 14-24 Pin Chips 3" + 6" IC widths

Tests/Identifies over 650 digital chips with ANY type of output in seconds. Also tests popular RAM chips. IBM compatible version \$250. C128 + C64 version \$150.

### DUNE SYSTEMS 2603 Wills Dr., St. Joseph, MI 4908

(616) 983-2352

Inquiry 634.

#### PC CARDS/KITS

- B bit A/D card, 0-5V
   B bit D/A card, 0-9.5V
   Reliay driver card, 8 outputs (9A)
   Reliay driver card, 8 outputs (9A)
   Digital I/O (8 TTL input/butput)
   JE XT computer kit w/maniter
   FREE CATALOG—parts, kits, computers \$79 \$79 \$149 \$79
- \$499

#### JB COMPU-TRONIX

orth Blyd., Wheat Ridge, CO 80033 3816 N.

(303) 425-6586

Inquiry 635.

LATEST VERSION AWARD BIOS NOW, you can have the latest AWARD BIOS for your PC/XT, 286 or 386. Upgrade your old machine for VGA, networking and new keyboard and hard five types. Fast, knowledgeable service, guaranteed results.

Gall 1-800-423-3400 (8:00 AM to 8:00 PM EST)

## KOMPUTERWERK, INC. 861 Parkview Blvd., Pitteburgh, PA 16216 For Info., call (412) 782-0384

inquiry 636.

#### 87C51 PROG. \$125.00

The UPA 87C51 Programming Adapter lets you use your general purpose programmer to program the 87C51, 8751H, AMDASSAH, 87C582, and 8762BH. Also lets you program the 87C51/8751H security bits and the 87C51 encryption array. It's very simple and VERY cost effective.

LOGICAL SYSTEMS CORPORATION 6184 Teall Station, Syracuse NY 13217 Telex 6715617 LOGS (315) 478-0729

inquiry 637.

OCTOBER 1988 . BYTE 303

#### HARDWARE

#### BUY \* SELL \* TRADE

Apple . IBM . Compag . Service Parts Accessories Systems

#### PRE-OWNED Electronics, Inc.

30 Clematis Avenue, Waltham, MA 02154

800-274-5343 FAX 617-891-3556 Service Centers and Dealers welcome

Inquiry 638.

#### SANYO 550/555 USERS

3.6/7.2MHZ TURBO BD. W/8088-2
IBM STYLE CGA VIDEO BD
IBM STYLE RS-232
HARD DISK CONTROLLER PKG \$139.95
768K MEM/CLK/EXPANSION BD
20 MEG HARD DISK SYSTEM \$549.95
COMPOSITE MONO MONITOR
550 COMMUNICATIONS SOFTWARE \$49.95
WARDA DAY BIGURAL

TAMPA BAY DIGITAL
1750 Draw St., Clearwater, FL 34815
FREE CATALOG ... 813-442-1577 818-443-7049

Inquiry 639.

## 68000 / 68020 / 68881 COMPLETE DEVELOPMENT SYSTEM

for the 68000, 68020 and 68681 chips-includes the chips, power supply, serial interface with software, 68000/68020 gross assembler (hosted on a PC), documentation, schematic, Operating System, cables. Special Price—\$1100.00

#### Phone URDA, Inc. 1-800-338-0517

Inquiry 640.

#### HARDWARE/ADD-ONS

#### USE JOYSTICK ONE-HANDED!

Still using your joystick two-handed? Hand sore from holding that joystick? STIK-FOOT™ lets you use any flat-bottomed joystick one-handed, and is easily installed. Just \$9.95, plus \$1.90 shipping, check or money order. Dealer inquiries welcome.

#### The Softwaresmith

Suite 131, 114 Daniel Webster Highway South Nashua, NH 03060

Inquiry 641.

#### HARDWARE/COPROCESSOR

SC/FOX"PARALLEL COPROCESSOR PC/XT/AT/386 plug-in beard with Forth software. 10 MIPS operation, up to 50 MIPS burst. 64k to 1M byte memory. Uses Harris RTX 2000" RISC realtime CPU with 1-cycle multiply, 1-cycle 14-priority interrupts, two 256-word stacks, three 16-bit timer/counters, 16-bit I/o bus. Ideal for real-time control, signal and image processing and multiple board operation. From \$1,995.

SILICON COMPOSERS, INC. (415) 322-8763 210 California Ave., Suite K, Palo Alto, CA 94306

Inquiry 642.

#### **IMAGE PROCESSING**

#### ZIP Image Processing

ZIP brings video image processing to the PC. Control imageWise video digilizer, use 1 or 2 serial ports to cap-ture/display images from any video source. Outstanding image display on EGA/EEGA/VGA in color and 64 gray levels. Call (314) 962-7833 for VISA/MC, or send check \$79 + \$2 s/n. MO add 5.8%.

304 BYTE · OCTOBER 1988

Hogware Company 470 Belleview, St Louis, MO 63119 (314) 962-7833

Inquiry 643.

#### INFORMATION

The "Economic Report of the President" has concise tables of the major economic indicators (GNR Employment, Inflation, Population the deficit, and much more.) The Tables of the 1988 Report are now available on disk in (CAL, WKS, CSV, or TXT) formats for (PC or MAC or most CP/M)— \$49.95

#### **FAIRFACTS**

Box 536, San Rafael, CA 94915 Tel. 415-485-1781

Inquiry 644.

#### **INVENTORY MANAGEMENT**

#### STOCK-MASTER 4.0

Commercial grade inventory management software at micro prices.

Supports all 12 \* Stock Status Reporting Activity History Analysis Bill of Materials Cuality Control • Multiple Locations • Open Order Tacking • Open Order Reporting • Open Order Reporting • Open Order Reporting • On Line Inquiry

- Multiple Locations
   Order Entry
   Purchase Order Tracking
   Open Order Reporting
   Sprial/Lot if Tracking
   Applied Micro Business Systems, Inc.

  177F Riverside Ave., Newport Beach, CA 92663
   714-759-9582

Inquiry 645.

#### LANS

Are you about to spend thousands of dollars for

#### Novell or 3-COM?

The invisible Network does the same thing, but costs only \$249 per machine. True NETBIOS-compatible Local Area Network with high-speed 18 Mbps interface cards, cables, and if networking software. Works great with Multi-user dBASE, Clipper, Quick-Gliyer, FoxBASE+, and all other file-sharing and

Database Specialties (415) 652-3630

P.O. Box 2975, Oakland, CA 94618

#### LAPTOP COMPUTERS

#### APTOP SPECIALS

Toshiba • Zenith • NEC • DATAVUE • SHARP • NEW! Hard drives available for Tandy 1400 LT & Toshiba 1100+ • AFFORDABLE 51/4" or 31/2" DRIVE UNITS for LAPTOPS & DESKTOPS • DICONIX PRINTERS • 768 card for T1000 • 2400 BAUD MODEMS for Laptops • Fast reliable and friendly service. For Low Pricing call

COMPUTER OPTIONS UNLIMITED 201-469-7678 (7 Days, 9 am-10 pm Eastern time)

Inquiry 646.

2 PC and 2pcLite
2 PC: Connects any two PC's for file transfer and communication.
Features \* 116,200 baud transfer rate \* directory trees \* chat mode
\* file tagging/weingddetelon\* \* pint facility \* universal cable \* free
cable wiring diagram (so you can "roll your own" cable) \* 3½"
\$ 5½" disks. Complete \* 556 (List \$50), without cable \$ 526 (List \$60), without cable \$ 526 (List \$60), without cable \$ 526 (List \$60), without cable \$ 530. Both programs have \$ 491ine mode.
Cables sold separately; ser/par, kbd, mon, & others

Thompson Computing, 587F N. Ventu Park Road, Suite 305, Newbury Park, CA 91320, (805) 498-7653. VISA/MC add 4%.

Inquiry 647.

#### LAP-LINK

The ultimate solution for linking laptop computer with any IBM compatible desktop PC. 115, 200 baud transfer rate—faster than any other product available. No installation necessary, easy to use split screen design. Includes incredible "universal cable" that connects any two computers. Transfer entire disks faster than a DOS copy command! Only \$129.95 including universal cable and both \$1/2" and \$4/4" disks. "Bridge" owners can trade in for only \$89.95 w/o cable.

Traveling Software, Inc. 19310 North Creek Parkway, Bothell WA 98011 -800-343-8080 (206) 483-8088 1-800-343-8080

Inquiry 648.

#### LEGAL

#### LEGAL DOCUMENT MAKER

All pleadings and documents. Any word processor software. Free Brochure. Newl Supra II™

#### TSC - The Software Company

P.O. Box 872687, Wasilla, AK 99687 (907) 373-6550

Inquiry 649.

#### MAC

#### DEVELOPMENT TOOLS

Professional Programmers Extender: Standard Mac interface, lists, printing, graphics, tilling. Ex-tender GraphPac: Quality color graphs. Line, bar, semi-log, customizable symbols

#### **INVENTION Software** (313) 996-8108

Inquiry 650.

#### MARKETING

#### FREE BROCHURE & CATALOG

If you have a computer product that you're marketing...or thinking about marketing...we can help. We'll help you get free publicity from com-puter magazine editors, user groups and computer stores. Send for a free brochure today.

DP Directory, Inc. 525 Goodale Hill Road, Ste. 410, Glastonbury, CT 06033 (203) 659-1065

Inquiry 651.

#### **MEMORY CHIPS**

MEMO	RY	CI	415	28	A.COLO	an arms
41256-15-12-10	Call	51000 (	1 Me	g)		Cal
4164-15	Call	61258				
4164-12	Call	8087-3-1				
41128 Piggy Back for AT	Call	80287-6				
41464-12 (64Kx4)	Call	80387 .				
414256 (256Kx4)		NEC-V-				
2764,27128,27256,27512		Mouse.				
Prices s						

ESSKAY

718-353-3353

Inquiry 652.

#### MONITOR INTERFACE

#### **DRIVE MULTIPLE MONITORS**

with one PC using our VOPEX video port expanders. Featuring no loss of resolution or color, presentations are more dramatic. We have a VOPEX for PC, PS/2, AAC II & workstations. Units are available from 2 to 10 output ports.

NETWORK TECHNOLOGIES INC. 800-RGB-TECH or 216-543-1646 MC/VISA/AMEX

19145 Elizabeth St., Aurora, OH 44202

Inquiry 653

#### MUSIC

#### MIDI - PC/XT \$84.95

WILDI - FE/AI

Your MDI Instruments can talk with your PC/KY via a
MIDIATORS. Software INCLUDED! KE Enote\* Sequence,
KE Eboard Spiliter/Auto-Chorde, & MIDI Monitor. Requires
256K, DOS 20+. Std. Serial Fort (COM or COM2) & std.
cables. Needs no modifications, exp. stot, or power sup. Introductory Price \$4456+509 vin, TX res. add 7.25% tax. MC,
VISA, Check (allow 10 days).

## Key Electronic Enterprises 9112 Hwy. 80 W., Suite 221-B, Fort Worth, TX 76116

(817) 560-1912

Inquiry 654,



Subscribe to BYTE now and save \$19 off the newsstand price —12 issues for \$22.95 instead of \$42.00! You'll also receive	☐ This is a renewal ord
our special IBM PC issue as part of your subscription.	ivallie
☐ IISA \$22 05/1 year ☐ Canada \$25 05 II \$ /1 year	Company

USA \$22.95/1	year	Canada	\$25.95	U.S./1	year	
Rill me						

Pay	/ment	encl	losed

_	Charant	0 0011	MICA		MantarCar
- 1	Ullarde	to my	VISA	1 1	MasterCard

Account #	
Expires	

Signature \_\_\_\_\_

Thic	ic	9	rangual	order	

	(Please Print)	
	(i lease i ilit)	
nnany		

Address \_\_\_\_\_ City/State \_\_\_\_\_

\_\_\_\_\_ Code \_\_\_\_\_ For direct ordering, call toll free 1 800 423-8272 weekdays 9

AM - 5 PM EST. In New Jersey, call 1 800 367-0218. Please allow 6-8 weeks for processing your subscription.



Subscribe to BYTE now and save \$19 off the newsstand price
—12 issues for \$22.95 instead of \$42.00! You'll also receive
our special IBM PC issue as part of your subscription.

	USA \$22	.95/1	year $\square$	Canada	\$25	.95	U.	.S./	year
--	----------	-------	----------------	--------	------	-----	----	------	------

☐ Bill me

Payment enclosed

 $\$  Charge to my  $\$  VISA  $\$  MasterCard

Account # \_\_\_\_\_ Expires \_\_\_\_\_

Signature \_\_\_\_\_

This is a renewal order.

Name \_

(Please Print) Company \_\_\_

Address \_\_\_\_\_ City/State \_\_\_\_\_

For direct ordering, call toll free 1 800 423-8272 weekdays 9 AM — 5 PM EST. In New Jersey, call 1 800 367-0218.

Please allow 6-8 weeks for processing your subscription.

\_\_\_\_\_ Code \_\_\_\_\_

48ATSU-2



### **BUSINESS**

REPLY

MAIL

FIRST CLASS MAIL

PERMIT NO. 684

TEANECK, NJ

POSTAGE WILL BE PAID BY ADDRESSEE



Subscription Dept. P.O. Box 7640 Teaneck, NJ 07666-9866







BUSINESS FIRST CLASS MAIL REPLY

PERMIT NO. 684

MAIL TEANECK, NJ

POSTAGE WILL BE PAID BY ADDRESSEE



Subscription Dept. P.O. Box 7640 Teaneck, NJ 07666-9866 NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES



#### PC BOARDS

#### P-C-B ARTWORK MADE EASY!

\* Help Screens \* Dip & Sip Library Printer or Plotter Artwork \* Auto-Router available \* ICON Menus Requirements: IBM or Compatible PC, 384K RAM, DOS 3.0 or later.

PCBoards: \$99.00

DEMO: \$10.00

#### **PCBoards**

2145 Highland Ave./Ste. 201, Birmingham, AL 35205 (205) 933-1122

Inquiry 655.

#### PROGRAMMER'S TOOLS

#### Microsoft QuickBASIC Does Database Management.

db/LIB Database Library is 100% dBASE file compat. Only \$139.00.

AJS Publishing, Inc. (800) 992-3383 (213) 215-9145 in CA.

#### C or T Pascal Code Instantly

Complete database in just minutes. Draw & Paint your screen, show what fields to use for indexes That's it—running source code in 6 seconds. Automatic context sensitive help, programmer docs on each program. \$389/TPascal ver. or \$499/TC or MS-C ver.

Call ASCII (800) 227-7681

Inquiry 656.

#### **TLIB™ 4.0 Version Control**

The best gets better! They loved TLIB 3.0: "packed with features... [does deltas] amazingly fast... excellent".—PC Tech Journal Sept 87. "has my highest recommendation".—R. Richardson, Computer Shopper Aug 87. Now TLIB 4.0 has: branching, more keywords, wildcards & file lists, revision merge, LAN and WORM drive support, more. MS/PC-DOS 2.x & 3.x \$99.95 + \$3 s&h. Visa/MC.

**BURTON SYSTEMS SOFTWARE** P.O. Box 4156, Cary, NC 27519 (919) 856-0475

Inquiry 657.

#### **TURBO PLUS \$99.95**

Programming tools for Turbo Pascal 4.0 Screen Painter, Code Generator, I/O Fields, Dynamic Menus, Programming Unit Libraries, Sample Programs, 280 Page Illustrated Manual. 60 Day Satisfaction Guaranteel Brochures & Demo Diskettes avail. Highly Favorable Reviews! IBM & Compatibles.

#### Nostradamus Inc.

3191 South Valley St. (Suite 252) Salt Lake City, UT 84109 (801) 487-9662

Inquiry 658.

#### **Get INSIDE!**

INSIDEI is a powerful software performance analysis tool for popular PC compilers. INSIDEI measures the execution time of every function or procedure with microsecond accuracy or computes how often each source line is executed. Simply compile your application and INSIDEI does the rest. \$75

## P.O. Box 152, Milford, MA 01757

(800) 537-5043 In MA: (508) 478-0499

Inquiry 659.

#### PROGRAMMER'S TOOLS

#### Modula-2

Graphix brings the widely used MetaWindow professional graphics library to users of JPI TopSpeed, Logitach, and other M2 compilers. Supports multiple fonts, image scaling, mouse tracking, many printers, and over 30 display adapters. Call for free demo. Only \$149 (\$189 with source). Includes MetaWindow package. From the creators of Repertoire (\$89), NetMod (\$69), Dynamatrix (\$69), EmsStorage (\$49), etc. MCVISA/AMEX/COD.

PM 4536 SE 50th, Portland, OR 97206 (503) 777-8844; TLX: 650-2691013

#### FREE BUYER'S GUIDE

See Page 39

Programmer's Connection is an independent dealer representing more than 250 manufacturers with over 750 softrepresenting more than 250 manufacturers with over 750 soft-ware products for IBM personal computers. Call to receive our FREE comprehensive Buyer's Guide or refer to page 39 of this issue to see a partial list of our software products.

**Programmer's Connection** 800-336-1166 216-494-3781

Inquiry 661.

#### **PUBLIC DOMAIN**

#### **OUTSTANDING IBM SOFTWARE** ONLY \$2.75/DISK OR LESS

Our collection contains the latest versions of the Best Shareware and Public Domain Programs. Most are menu driven with full documentation. 350" format is also available. Orders shipped First Class Within 24 hours and Satisfaction is guaranteed. Write for free printed catalogue or send a 250 stamp for a disk catalogue.

**A.C.L.** (916) 973-1850 1621 Fulton Ave., Suite #35-B, Sacramento, CA 95825

Inquiry 662.

#### \$3.00 SOFTWARE FOR IBM PC

Hundreds to choose from, wordprocessors, databases, spreadsheets, games, lotto, communications, business, music, bible, art, education, language and useful utilities for making your computer easier to learn. Most programs have documentation on the disk.

WRITE FOR YOUR FREE CATALOG TODAY!

BEST BITS & BYTES P.O. Box 8245, Dept-B, Van Nuys, CA 91409 In CA: (818) 781-9975 800-245-BYTE

Inquiry 663.

### **FREE SOFTWARE** BEST OF PUBLIC DOMAIN & SHAREWARE.

Carefully selected and edited programs for I.B.M. Send S.A.S.E. for free catalog.

C.C.S., Inc. Dept. B1 P.O. Box 312, Lafayette Hill, PA 19444

Inquiry 664.

#### **RENT SOFTWARE \$1/DISK**

Rent Public Domain and User Supported Software for \$1 per diskfull or we'll copy. IBM (3½" also), Apple, C-64, Sanyo 550 and Mac. Sampler \$3. VISA/MC. 24 hr. info/order line. (619) 941-3244 or send #10 SASE (specify computer) Money Back Guarantee!

## FutureSystems Box 3040 (T), Vista, CA 92083 office: 10-6 PST Mon.Sat. (619) 941-9761

Inquiry 665.

#### **PUBLIC DOMAIN**

#### **FREE SOFTWARE**

Buy or Rent \$1/disk

World's largest Free Software Library of IBM PC & Compatibles and Macintosh. Over 3000 programs for Religion, Utilities, Business, Com., Word Processor, Education, and Games on 5.4" and 3.5" format. Best quality, Lowest rate, and Fastest service. For fast free catalogue write to:

#### SOFTSHOPPE

P.O. Box 15022, Ann Arbor, MI 48106 (313) 763-8721

Inquiry 666.

#### \$4.00 SHAREWARE \$4.00

IBM-PC Compatible Software

- Over 700 Disks to Choose From
   Not Half Full Like Some Distributors
- Dozens of Programs in All Categories Call or Write for FREE Catalog on Disk

  — Please specify 5¼" or 3½" Disk —

The Software Kingdom

P.O. Box 555, Auburn, NH 03032-0555 1-800-552-DISK (In N.H.) (603) 483-5055

Inquiry 667.

#### FREE SOFTWARE

We send you 15-20 new IBM programs a month on 5 disks—FREE! You pay only \$5. shipping/handling. Annual membership reg. \$29.95. Join today for only \$9.95 and we'll send you over 30 programs on 10 disks as a bonus—FREE! No gimmicks—no catches!

toll free 800 669-2669 ext 348

#### SOFTWARE of the MONTH CLUB we take visa/mastercard/amex

Inquiry 668.

#### GRADEASE OR CHECKEASE

GRADEASE FOR TEACHERS is the ultimate! Maintains

GHADEASE FOR I EACHER'S is the ultimate! Maintains grades. Prints class lists, reports, and seating charts. (IBM, Apple II, C64/128)
CHECKEASE FOR EVERYBODY is the best checkbook program available. Tracks bills. Records tax info. Reconciles unlimited accounts. Prints checks and user formatted reports, and more!!! (IBM only). Shareware \$10 or \$29.95 for registration (+ \$2 P&H) SOFTWARR

11919 Barrytree Drive, Houston, Texas 77070 (713) 955-8210

Inquiry 669.

#### **SCANNING SERVICE**

#### Signature Scanning Service

If you have a HP LaserJet Plus, Series II or compati-ble, have your signature made into a graphic macro. Save time! Save yourself from writer's cramp! Let your LaserJet sign those letters for you! Includes instructions for most popular word processors. One signature only \$50. Three or more, only \$40 each. Logos and let-terheads also available from \$125. Send for free samples! samples!

Orbit Enterprises, Inc. P.O. Box 2875-BY, Glen Ellyn, IL 60137 (312) 469-3405

Inquiry 670.

#### SECURITY

#### TOTAL PRIVACY \$49

Powerful data protection for PC/AT—documents, databases, spreadsheets—any data. The Diary's DES and Ultra Fast encryption keep the curious out. Menu and command line modes. Comprehensive Help. Clear manual starts you qui

#### 1-800-87-DIARY

Toll Free Information 24 Hours a Day
Or write, P.O. Box 70443, Bellevue, WA 98007

Inquiry 671.

#### SECURITY

BIT-LOCK® SECURITY
Piracy SURVIVAL 5 YEARS proves effectiveness of powerful multilayered security. Rapid decryption algorithms. Reliable/small port transparent security device. PARALLEL or SERIAL port. Countdown and timeout options also available. KEY-LOK™ security at about 1/2 BIT-LOCK cost.

#### **MICROCOMPUTER APPLICATIONS**

3167 E. Otero Circle, Littleton, CO 80122 (303) 922-6410

Inquiry 672.

#### COPY PROTECTION

The world's leading software manufacturers depend on Softguard copy protection systems. Your FREE DISKETTE introduces you to SuperLock"—invisible copy protection for IBM-PC (and compatibles) and Macintosh. · Hard disk support No source code changes
 LAN support

Customized versions

New upgrades available

(408) 773-9680 (408) 773-9680 (408) 773-9680 (408) 773-9680 (408) 770 Lakeway, Suite 200, Sunnyvale, CA 94086 FAX (408) 773-1405

Inquiry 673.

#### SMALL BUSINESS SYSTEMS

#### SMALL BUSINESS SYSTEMS

SIMALL BUSINESS SYSTEMS
Finally, a complete computer system classroom designed and field tested with the Small Business Owner in mind. Business capital of America we pro-ulty present "The Y.E.S.I Collection" (2) fivor. Efficiency System). Several modules written by New England's Ross Ballard II. If you are starting a new business or have been in business for less than two years, and can work with professional trainers via telephone then the Y.E.S.I(c) curriculum is for you. Choose for mour "Starting a New Yestrue". "The Home Based Busines" or "Women in Business" each bult around NCR Hardware and our unique accounting software that we help you customize. Ask, yourself if you business deserves the best then say "Y.E.S.I" Write or call now for our free brochure.

ALTERNATIVE BUSINESS TRAINING, INC. 206 Washington Street, Kee 1-800-328-7677 ne, NH 03431 (In NH 357-5111)

Inquiry 674.

#### SOFTWARE/ACCOUNTING

#### **ACCOUNTING TUTOR \$79.95**

Peanuts and Caviar Accounting Software is designed to introduce the principles of accounting and bookkeeping to non-accountants through its software and textbook. It then may be used as your business' accounting software. Being used by educational institutions to teach accounting (e.g., Pepperdine, etc.) \$79.00

#### COUNTERTRADE PRODUCTS, INC.

5145 Idylwild Tr., Boulder, CO 80301 303-530-5433

Inquiry 675.

#### dBASE BUSINESS TOOLS

- General Ledger Accounts Recvbl.
- \* Purch Ord/Invntory
  \* Accounts Payable
- Order Entry \* Sales Analysis
- \* Job Costing \* Job Estimating

\$99 EA. + s&h w/dBASE 2. 3 or 3 + SOURCE CODE

dATAMAR SYSTEMS 4876-B Santa Monica Ave.

Cr. Crd/Chk/COD

(619) 223-3344 San Diego, CA 92107

#### SOFTWARE/ASTRONOMY

## EARTH SATELLITE FORECASTS

SPACE BIRDS predicts visibility of earth satellities such as Mir, Salyut 7, NOAA 10 against the star background; runs on PC/XT/AT. Described in BYTE 6/88, p. 82. Reviewed in Sky & Telescope 7/88, p. 70. Quarterly Space Omithology Newsletter keeps SPACE BIRDS purchasers informed. Inquire for details

#### **Astronomical Data Service**

P.O. Box 26180, Colorado Springs, CO 80936

(719) 597-4068

306 BYTE • OCTOBER 1988

Inquiry 677.

#### SOFTWARE/BASIC

#### LOOKING FOR **COMPILED BASIC TOOLS?**

Having trouble finding tools, books and utilities for Compiled BASIC? We carry a full line. Call KOMPUTERWERK for our FREE Catalog:

1-800-423-3400

#### KOMPUTERWERK, INC.

851 Parkview Blvd. Pittsburgh, PA 15215 For info, call (412) 782-0384

Inquiry 678

#### SOFTWARE/BASIC TOOLS

#### QuickWindows

As seen in the Microsoft Value-Pack Catalog! Create windows, pop-up and pull-down menus, data-entry Create windows, pop-up and puin-down menus, data-entry screens, and multiple-input dialog boxes quickly and easily. Full support of Microsoft mouse. Join the many Fortune 500 companies using QuickWindows and order your copy today. QuickWindows \$79. Advanced \$139. For Microsoft QuickBASIC or BASCOM. See pg.78, BYTE, March '88.

Software Interphase, Inc. 5 Bradley St., Suite 106 • Providence, RI 02908 Call now for Free Demo Disk (401) 274-5465

Inquiry 679.

#### SOFTWARE/BUSINESS

#### DATA ENTRY SYSTEM

Heads-down data entry with two-pass verification for the PC/XT/AT - PS/2 & compatibles. Loaded with features like: Auto dup & skip, verify bypass, range checks, & table lookups. Fully menu driven only \$395.

Call for free 30 day trial period.

#### COMPUTER KEYES

21929 Makah Rd., Woodway, WA 98020 (206) 776-6443 1-800-356-0203

#### **TSA88-TRANSPORTATION**

A general-purpose system for solving transportation, assignment and transhipment problems. Solves transportation problems with up to 510 origins and/or destinations by applying the Transportation Simplex Algorithm. Menu-driven with features similar to LP88. Requires 192K, \$149 with 8087 support user's guide.

EASTERN SOFTWARE PRODUCTS, INC. P.O. Box 15328, Alexandria, VA 22309

(703) 360-7600

Inquiry 680.

**dFELLER Inventory**Business inventory programs written in modifiable dBASE

source code.

source code.

dFELLER Inventory \$150.00

Requires dBASE II or III, PC-DOS/CPM

dFELLER Plus \$200.00

with History and Purchase Orders

Requires dBASE III or dBASE III Plus (For Stockrooms)

Feller Associates 550 CR PPA, Route 3, Ishpeming, MI 49849

(906) 486-6024

Inquiry 681.

#### **FINANCE MANAGER II**

Easy to learn, fully integrated, menu-driven bookkeeping system for small business and personal use. IBM PC, XT, AT, PS/2 or compatible. Try before you buy! General Ledger evaluation copy for only

CALL TODAY! (719) 528-8989 HOOPER INTERNATIONAL: PO Box 62219, Colorado Springs, Colorado 80962

Inquiry 682.

#### SOFTWARE/CHURCH

#### PowerChurch Plus®

Fast, friendly, reliable church administration system. Full fund accounting, mailing lists, membership, contributions, attendance, word processing, accts. payable, payroll, multi-user support, and much more - all for \$695 complete. FREE demo version.

#### F1 SOFTWARE

P.O. Box 3096, Beverly Hills, CA 90212 (213) 854-0865

Inquiry 683.

#### ROMAR CHURCH SYSTEMS™

Membership-61 fields plus alternate addresses; labels, letters, reports any field(s). Offering:256 funds; optional pledge; up to 500 subtotals & 99 depts., month & YTD reports anytime for any month. Attendance—8 service times, 250 events per service; 60 consecutive weeks. Available for floppy, 3½ & hard disk. Ad too short! Write for free 48-page guide.

Romar Church Systems, Attn: BJB P.O. Box 4211, Elkhart, IN 46514 (219) 262-2188

Inquiry 684.

#### SOFTWARE/ENGINEERING

#### PRACTICAL ENGINEERING TOOLS Hobbyists—Students—Engineers

CIRCUIT DESIGN\_CompDes, menu selections from basic electricity through circuit designs.

MATHEMATICS\_CompMath, menu selections from general matth through statistics.

ANALYSIS\_CompView. Fourier Analysis of waveforms and filters. PC/MSDOS. \$49 each. VISA/MC

BSOFT SOFTWARE (614) 491-0832 444 Colton Rd., Columbus, OH 43207

Inquiry 685.

#### Affordable Engineering Software

FREE APPLICATION GUIDE & CATALOG Circuit Analysis • Root Locus • Thermal Analysis • Plotter Drivers • Engineering Graphics • Signal Processing • Active/Passive Filter Design • Transfer Function/FFT Analysis • Logic Simulation • Microstrip Design • PC/MSDOS • Macintosh • VISA/MC

BV Engineering • Professional Software 2023 Chicago Ave., Suite B-13, Riverside, CA 92507 (714) 781-0252

Inquiry 686.

#### **VERSATILE DSP & DISPLAY**

PC DATA MASTER is a DOS shell which integrates a full set of signal processing functions: flexible graphics, data file math, DSP utilities, data sampling/generation, and interactive help. Support for CGA, EGA, VGA, Herc & AT&T. Add custom analysis or graphics functions easily using your favorite compiler. \$135. Toolkit \$45. Demo \$10.

**Durham Technical Images** 

P.O. Box 72, Durham, New Hampshire 03824-0072 (603) 868-5774

Inquiry 687.

### Engineer's Aide

Join the Desktop Engineering Revolution!

- Pipeline/Ductwork Sizing
   Pump/Fan/Compr. Sizing
   Pump/Fan/Compr. Sizing
   Heat Exchanger Sizing
   Heat Exchanger Sizing
   Conversion Calculator
   Specification Writer
   Above programs in one stand alone integrated package for \$695. For IBM PC & Macintosh.

#### EPCON

1-800-367-3585 P.O. Box 270, Woodsfield, OH 43793

Inquiry 688.

#### SOFTWARE/ENGINEERING

#### COMPOSITE ANALYSIS

Menu driven program for analyzing composite laminates.

- · Calculates fiber stresses & strains
- Graphical strength ratios
   Database includes Graphite, Kevlar & Fiberglass
   SI/US units; thermal & moisture effects

Send check/MO for \$225 or \$3 for demo disk to:

GS composites 7627 E.37th N. #706, Wichita, KS 67226

Inquiry 689.

#### SIMULATION WITH GPSS/PC™

GPSS/PC\* is an IBM personal computer implementa-tion of the popular mainframe simulation language GPSS. Graphics, animation and an extremely interac-tive environment allow a totally new view of your simula-tions. Simulate complex real-world systems with the most interactive and visual yet economical simulation contents. software.

#### **MINUTEMAN Software**

(508) 897-5662 ext. 540 (800) 223-1430 ext. 540

Inquiry 690.

#### Circuit Analysis — SPICE

Non-linear DC & Transient; Linear AC. \* Version 3B1 with BSIM, GaAs, JFET, MOSFET, BJT, diode, etc. models, screen graphics, improved speed and convergence. \* PC Version 2G6 available at \$95.

Call, write, or check inquiry # for more info.

Northern Valley Software 28327 Rothrock Dr., Rancho Palos Verdes, CA 90274

(213) 541-3677

Inquiry 691.

#### FREE ENGINEERING MAGAZINE

Personal Engineering is a monthly magazine sent free of charge (USA only) to scientists/engineers who use PCs for technical applications. Topics each month include Instrumentation • Data Acq/Control • Design Automation. To receive a free sample issue and qualification form either circle below or send request on letterhead to:

Personal Engineering Communications

Box 1821, Brookline, MA 02146

Inquiry 692.

#### **EC-Ace ANALOG CIRCUIT ANALYSIS**

You can afford to get started with EC-Ace, a subset of the powerful ECA-2 circuit simulator. Includes all the the powerful ECA-2 circuit stribution. Includes an basics and builtin graphics.

• AC, DC, Temperature, Transient

• A full 525 pg. ECA-2 manual.

• Interactive, twice as fast as SPICE.

EC-Ace 2.31 IBM PC or Mac \$145.

Call 313-663-8810 for FREE DEMO

Tatum Labs, Inc. 1478 Mark Twain Ct., Ann Arbor, MI 48103

Inquiry 693.

#### SOFTWARE/FINANCIAL

#### "THE FINANCIAL PLANNER" SOFTWARE

SAVE 40% Retail \$99.95 -OUR PRICE \$59.95 (+2.00 S/H)
PA residents add 6% Tx. Menu Driven program w/printed Manual.

Balance Checkbook

- •Loan Amortization Schedule
- Prepare Budgets
   Prepare Financial Statements
   Plan Savings & more

Specify Apple IIc, IIe, IIgs, IBM PC or Compatible. CKS/MC/VISA SHIPPED UPS

SOFTECH INDUSTRIES, INC. 717-584-5191 RD 1, Bx 117A, Dept B901, Hughesville, PA 17737

Inquiry 694.

#### SOFTWARE/FORECAST

#### FORECAST PRO

An excellent forecasting package that uses artificial intelligence to help both the beginner and the experienced forecaster achieve top-notch results. Time series analysis techniques include exponential smoothing, Box-Jenkins, & dynamic regression.

#### CALL NOW FOR A FREE DEMO DISK!

Business Forecast Systems, Inc. 68 Leonard Street, Belmont, MA 02178 (617) 484-5050 TELEX #710-3201382

Inquiry 695.

#### SOFTWARE/GEOLOGICAL

#### GEOLOGICAL CATALOG

Geological software for log plotting, gridding/contouring, hydrology, digitizing, 3-D solid modelling, synthetic seismogram, fracture analysis, image processing, scout ticket manager, over 50 programs in catalog. Macintosh too! Please call, or write, for Free Catalog!

RockWare, Inc. 4251 Kipling St., Suite 595, Wheat Ridge, CO 80033 USA (303) 423-5645

#### SOFTWARE/GRAPHICS

#### TurboGeometry Library

Over 150 2&3 dimensional routines, includes Intersec-Over 150 283 dimensional routines, includes intersections, Transformations, Equations, HiddenLines, Perspective, Curves, Areas, Volumes, Clipping, Planes, Vectors, Distance, Polydecomp, IBM PC and Comp. MAC. MSDOS 2+. Turbo Pascal, Turbo C, MSC & Turbo Pascal MAC. 400 pg. manual, source code. \$149.95 + 5.00 S&H. VISA, MC, Chk, PO. 30 Day guarantee.

Disk Software, Inc. 2116 E. Arapaho #487, Richardson, TX 75081 (214) 423-7288

Inquiry 696.

#### E G

SCIENTIFIC & ENGINEERING GRAPHICS SYSTEM

See "What's New" pg 82, BYTE June, 1988 Log, Data & Linear Axes; Curve Fitting & Smoothing 1-2-3 Interface; Numeric Spreadsheet. Supports all Video Standards, PC Printers & Plotters. 10 Curves w/5000 points each. Plus much more. Call Today.

#### **Edmond Software**

3817 Windover Drive Edmond, Oklahoma 73013

1-405-842-0058 1-800-992-3425

Inquiry 697.

#### FPLOT PEN PLOTTER EMULATOR

Use your dot matrix or laser printer as an HP pen plotter. Fast hi-res output. Vary line width. Includes VPLOT virtual plotter utility to capture plotting commands. Supports NEC P5/P6, IBM Proprinter, Epson LQ/MX/FX, HP Laserjet. Uses Hercules, CGA, EGA or VGA for screen preview. \$64 check or m.o.

#### **FPLOT CORPORATION** Suite 605, 24-16 Steinway St., Astoria, NY 11103

212-418-8469

Inquiry 698.

#### **GRAPHICS PRINTER SUPPORT**

AT LAST! Use the PrtSc key to make quality scaled B&W or color reproductions of your display on any dot matrix, inkjet, or laser printer. GRAFPLUS sup-ports all versions of PC or MS-DOS with IBM (incl. EGA, VGA), Tecmar, and Hercules graphics boards. \$49.95.

Jewell Technologies, Inc. 4740 44th Ave. SW, Seattle, WA 98116 800-628-2828 x 527 (206) 937-1081

Inquiry 699.

#### SOFTWARE/GRAPHICS

#### FORTRAN PROGRAMMER?

Now you can call 2-D and 3-D graphics routines within your FORTRAN program.

GRAFMATIC: screen routines \$135.
PLOTMATIC: pinter driver 135.
For the IBM PC, XT, AT & compatibles. We support a variety of compilers, graphics bds., plotters and printers.

#### **MICROCOMPATIBLES**

301 Prelude Dr., Dept. B, Silver Spring, MD 20901 USA (301) 593-0683

Inquiry 700.

#### SOFTWARE/LANGUAGES

#### FORTHWITH DRUMA FORTH-83

Powerful. Well designed. User friendly. Attractively pric-ed. Enhance productivity. Reduce development time.

No 64K limit, 16 bit speed to 320K, 1Mb+ memory.
On-line dodglossary, full DOS & file interface.
Assembler, editor, examples, mary utilities
15 day unconditional guarantee. From \$79, S814 S2, VISAMC.
IBM PCIXTAT & all compatibles. Other packages: inquire

DRUMA INC. 6448 Hwy. 290 East E103, Austin, TX 78723 Orders: 512-323-0403 BBoard: 512-323-2402

Inquiry 701.

#### **FORTRAN for Macintosh**

Language Systems FORTRAN is a full-featured FOR-TRAN 77 compiler integrated wMPW. Full ANSI FOR-TRAN 77 plus VAX-type extensions. SANE numerical calculations & data types incl. COMPLEX-16. 68000, 68020 and 68881 object code. Arrays greater than 32K. Link with Pascal, C, MacApp. \$304 w/MPW via air. MC/VISA/Check. MAC+, SE, Mac II. HD req.

Language Systems Corp. 441 Carlisle Drive, Herndon, VA 22070 (703) 478-0181

Inquiry 702.

#### SUBPROGRAM LIBRARIES

Five volumes of source code: Math, Statistics, Graphics, DOS Five volumes of source code: Math, Statistics, Graphics, DUS & BIOS & I/O functions. Spectroscopy. I p to 98% less user code with our fully tested library. Manuals with examples guarantee fast success. Portability insured for BASIC, PASCAL under MS-DOS, Mac-OS, VMS, HP300. Prices start \$145 per volume. 30 day \$ back. VISA/MC/P.O.

Scientific LOGICS, Inc. 21910 Alcazar Ave., Cupertino, CA 95014 Ph.# 408-446-3575 Compuserve 74017,663

Inquiry 703.

### SOFTWARE/LOTTERY

PC—LOTTO VER 2.1 (+CLUB) \$50 US REGISTERED COPY. INCLUDES ONE YEAR MEMBERSHIP IN PC-LOTTO CLUB, NEWSLETTER + A NEW VERSION ONE YEAR LATER. COMES WITH MOST U.S. AND CANA-DIAN LOTTOS, AUSTRALIA. SHAREWARE VER-SION \$8 US OR ASK PC-CLUBS, MAIN BBS, FREEWARE HOUSES. (IBM-PC comp)

#### LOTTOWARE

870 Gladiola Ave., Victoria B.C. CANADA V8Z 2T6 (604) 479-8536

Inquiry 704.

#### SOFTWARE/MATHEMATICS

### What? You've never seen

a complex function? Try f(z) - The Complex Variables Graphing Package for PC's with CGA/EGA

"Let our animated screens show you what the printed page cannot.

### Lascaux Graphics

(212) 654-7429

Inquiry 705.

#### SOFTWARE/PACKAGING

HARD TO FIND COMPUTER SUPPLIES FOR

SOFTWARE DEVELOPERS & POWER USERS
Cloth binders & slipcases like IBM's. Vinyl binders,
boxes, and folders in many sizes. Disk pages,
envelopes, & labels. Low quantity imprinting. Bulk disks. Everything you need to bring your software to market. Disk and binder mailers. Much more! Low Prices! Fast service. Call or write for a FREE CATALOG.

Anthropomorphic Systems, Limited 376 E. St. Charles Rd., Lombard, IL 60148 1-800-DEAL-NOW 312-629-5160

Inquiry 706.

#### SAVE SAVE SAVE ET'S TALK LABELS

We do disk labels (51/4" & 31/2)

● Better ● Faster ● Cheaper ●
Because we specialize in disk labels...Let's Talk

We also have Tyvek Sleeves

Mailers • Binders • Vinyl Pages
We are a complete software packaging service. **Hice & Associates** 

9303 Cincinnati-Columbus Rd., West Chester, OH 45069 513-777-0133

Inquiry 707.

#### SOFTWARE SCIENTIFIC

#### DATA ACQUISITION & ANALYSIS ON PC'S

- Free application assistance. Tell us about your DSP, process control, AID or DIA needs. Our expert engineering staff will provide you with a system solution to fit your needs and budget.

  AID & IEEE 488 boards from MetraByte, Scientific Solutions and

Analog Devices.

Analysis software including PRIME FACTOR FFT subroutine library, FOURIER PERSPECTIVE II advanced linear systems analysis. When ut driven software from Unkel, Laboratory Technologies, Quincuris, and Golden, Scientifickenginering 2 & 3D graphics.

See "What's New" page 80, BYTE July, 1988 ALLIGATOR TECHNOLOGIES

P.O. Box 9706, Fountain Valley, CA 92708 Tel. (714) 850-9984 FAX. (714) 850-9987 MCI. ALLIGATOR

Inquiry 708.

#### **POWERFUL EQN SOLVER** \$99 RISK FREE OFFER WITH FREE WORD PROCESSOR!

\$99 RISK FREE OFFER WITH FREE WORD PROCESSOR!

"A real Bargian" IEEE > "Dex over 40 years by aerospace vets" EE TIMES • "Defines new functions" Engly Tools CURVET • Graph results ACROSS SINGULARTILES • Change parameters/conditions • Fit 60th order curves to imported data • COMPLEX/real roots • Diff Eq • Indefinite Integrals • More • MS-DOS, 640k, graphics card Call Today! 800/621-0849 x 330

8:30-5:30 PTIMe • VISA/MC/AMEX/Check

Curve System International

747 Moreno Ave., LA, CA 90049

Inquiry 709.

#### Spectra Calc Data Processing

Acquire and analyze data from commercial or custom analytical instrumentation. Fast real-time display, WYSIWYG plotting. Extremely fast applications for curve fitting, deconvolution, PLS algorithms etc. Spectral search and archive. Array programming language includes matrix, FFT, graphic commands.

GIC

395 Main St., Salem, NH 03079 800-862-6004 603-898-7600 FAX 603-898-6228

Inquiry 710.

#### ORDINARY/PARTIAL DIFFERENTIAL EQN SOLVER

FOR THE IBM PC & COMPATIBLES

#### MICROCOMPATIBLES INC.

301 Prelude Dr., Silver Spring, MD 20901 (301) 593-0683

308 BYTE • OCTOBER 1988

Inquiry 711.

#### SOFTWARE/SCIENTIFIC

#### "powerful and easy to use..."

Ask for our free 16 page brochure with complete product descriptions and detailed technical application notes (and for a brief description of two of our products see "What's New", Byte, page 84, July/88).

#### MicroMath Scientific Software

2034 East 7000 South Salt Lake City, Utah 84121-3144 (801) 943-0290

Inquiry 712.

Scientific/Engineering/Graphics Libraries
Turbo & Lightspeed Pascal, Modula-2, C
Send for FREE catalogue of software tools for Scientists and
Engineers. Includes: Scientific subroutine libraries, device
independent graphics libraries (including EGA, HP plotter
and Laserjet support), scientific charting libraries, 3-D plotenting library, data acquisition libraries, menu-driven process
control software. Versions available for a variety of popular

#### **Quinn-Curtis**

1191 Chestnut St., Unit 2-5, Newton, MA 02164 (617) 965-5660

Inquiry 713.

#### **Scientific Software**

Scientific CALCULATOR parallel processing & graphics, Sci.NOTEPAD free-form data management. praphics, Sci.NOI EPAD free-form data management, DIALSEARCH literature searches, SCI.GRAPHPAD and SCI.STATPAD graphics-aided data analysis (log/semilog plots, error bars, curve fit, more). From \$85-On 5½ and 3½" MS-DOS disks. 30 day \$ back. VISA/MC/PO. Also see our ad under LANGUAGES.

Scientific LOGICS Inc. 21910 Alcazar Ave., Cupertino, CA 95014
(408) 446-3575 Compuserv 74017,663

Inquiry 714.

#### KALMAN FILTERING SOFTWARE

D. Bierman's FORTRAN programs and source code libraries as still in use at JPL and vastly simplify use or development of Kalman Filter applications. These highly regarded algorithms and code implementations are compiled to run on PCMS DS-based machines or for your own development in source code. All code is fully documented.

Bierman Estimator Program (Executable). . . . \$250 Bierman Estimator Program (Source Code). . . \$500 Bierman Estimation Subroutine Library (Source Code)\$1500 514\* Flopples or 0 Track Tape

TAU CORPORATION 485 Alberto Way, Los Gatos, CA 95032 408 395-9191 • TELEX: 184302 TAU UT

Inquiry 715.

#### SOFTWARE/SECURITY

#### KEEP YOUR PC PRIVATE!

MicroLock PC Security Software protects MS-DOS files and programs from unauthorized access. MicroLock features unlimited passwords, Quick Encryption, Locks Directories, Hides files, Locks .EXE and COM files, uses one simple control menu wion-screen help!

Only \$89.95! (+\$3 s/h) 30 DAY MONEY BACK GUARANTEE Check/Visa/MC

#### MicroNiche, Inc.

The Summit, Suite 110, 4350 Brownsboro Rd.
Louisville, KY 40207

Orders: (502) 893-4526 FAX: (502) 893-4503

Inquiry 716.

#### HANDS OFF THE PROGRAM®

- Locks Hard Disk. Restricts Floppy Use.
  Protects Subdirectories.
  Normal Use of DOS Commands and Application Software.
  IBM PC, XT, AT and True Compatibles.
  DOS V20 and Higher. Hard Disk System.
  Keep Other People's HANDS OFF Your System.
  - VISA/MC

### SYSTEM CONSULTING, INC.

314 Canterbury Dr., Pittsburgh, PA 15238 (412) 963-1624

Inquiry 717.

#### SOFTWARE/SORT

#### **OPT-TECH SORT/MERGE**

Extremely fast Sort/Merge/Select utility. Run as an MS-DOS command or CALL as a subroutine. Supports most languages and filetypes including Btrieve and dBASE. Unlimited filesizes, multiple keys and much more! MS-DOS \$149. XENIX \$249.

(702) 588-3737

#### **Opt-Tech Data Processing**

P.O. Box 678 - Zephyr Cove, NV 89448

Inquiry 718.

#### SOFTWARE/TAX PREP

#### W-2 & 1099 ON FLOPPY

The MAG COLLECTION of programs make an IRS/SSA FOR-MAT floppy from a data entry screen or imported ASCII file. Includes manual and application forms.

- Used nation wide
   Step-by-step data entry
   Free phone support

#### Illinois Business Machines Inc.

Department MAG 1403 Box 310 Troy Rd., Edwardsville, IL 62025 PH. # (618) 692-6060

Inquiry 719.

#### SOFTWARE/TOOLS

**NATURAL LANGUAGE SOFTWARE** Use JAKE to create a front end to your database, game, or graphics program! JAKE translates English queries and commands into C function calls and data structures. JAKE offers context-sensitive semantic processing; interfaces easily; <64K mem.
\$495. INTERACTIVE DEMO \$10

ENGLISH KNOWLEDGE SYSTEMS, INC. (408) 438-6922

Inquiry 720.

#### **STATISTICS**

#### STATA

Statistics and graphics join to make STATA the most powerful package for the PC. No comparable program is as fast, friendly, and accurate. \$20 Demo. Quantity discount available. Call toll-free for more information. AX/VISA/MC.

#### 1-800-STATAPC

Computing Resource Center 10801 National Boulevard, Los Angeles, CA 90064 (213) 470-4341

Inquiry 721.

#### THE SURVEY SYSTEM

An easy-to-use package designed specifically for questionnaire data. Produces banner format, cross tabs & related tables, statistics (incl. regression) & bar charts. Codes and reports answers to open-end questions. All reports are camera-ready for professional presentations. CRT interviewing option.

CREATIVE RESEARCH SYSTEMS
15 Lone Oak Ctr., Dept. B, Petaluma, CA 94952

707-765-1001

#### STATISTICS CATALOG!

If you need statistics for IBM PC or Apple II, call us and let our technical advisors help you find the statistics programs you need. Write or call now to get a FREE catalog of statistics and quality control software.

#### **HUMAN SYSTEMS DYNAMICS**

(818) 993-8536 (CA)

9010 Reseda Blvd., Ste. 222 Northridge, CA 91324 (800) 451-3030

Inquiry 722.

#### **STATISTICS**

#### **RESULTS NOT SIGNIFICANT?**

Next time use EX-SAMPLE. Expert program estimates sample size using power analysis for comparisons of means, props, regression, ANOVA, chi-square, log-linear, ILSREL, surveys, experiments, many more. Justify sample size to funding agencies, plan sampling budget. Can pay for itself in a single study. IBMMS-DOS, \$195+51h. (50% educ. disc.), VISAMCIAMEXIPO, 30-day guarantee. Call now for EBEE brochuse.

The Idea Works, Inc. 100 West Briarwood, Columbia, MO 65203 1-800-537-4866

314-445-4554

Inquiry 723.

#### NCSS

Professional, easy to use, menu driven statistical system. Used by over 5,000 researchers.

• 5.0 Statistical System —\$99
• 5.1 Graphics (2D & 3D)—\$59
• 5.3 Power Pac Supplement—\$49
• 5.4 Exp. Design/CC—\$49
• 5.5 Surrival Analysis—\$49
We accept checks, PO's, Visa, MC. Add \$3 s/h.

\*\*NCSS-B\*\*
865 East 400 North, Kaysville, UT 84037
801-546-0445

Inquiry 724.

#### STATISTIX™ II

Comprehensive, powerful and incredibly easy-touse. Full screen editor, transformations, linear models (ANOVA, regression, logit, PCA, etc), ARIMA, most standard stat procedures. Clear, well organized documentation. Satisfaction guaranteed. \$169 PC DOS, \$99 Apple II.

#### NH ANALYTICAL SOFTWARE P.O. Box 13204, Roseville, MN 55113 (612) 631-2852

Inquiry 725.

### **EcStatic**

\$49.95

A full featured statistical package that's powerful, convenient, astonishingly easy to use and extraordinarily inexpensive. At last! A statistical package that gives you the tools you need, the clarity you want and at a price you can afford. Ideal for researchers, professionals, and students. Volume discounts available. To order call or write to:

## SomeWare In Vermont, Inc. PO. Box 215, Montpeller, VT 05602 1-800-451-4580 (496-3173 in Vermont)

Inquiry 726.

#### StatPac Gold™

Voted World's Best Statistical & Forecasting Package in 1987 by PC World Magazine readers. Six times more votes than the next closest competitor. More comprehensive & easier to use than all others. Get the facts. Call now for your FREE brochure.

1-800-328-4907

### Walonick Associates, Inc.

6500 Nicollet Ave. S., Minneapolis., MN 55423 (612) 866-9022

Inquiry 727.

Inquiry 728.

### TEXT RETRIEVAL

#### TEXT RETRIEVAL

- GOfer, high speed text retrieval software for IBM PC compatible and Apple Macintosh computers. Highly accidimed.

  No file conversion or indexing required.
  Searches for text in any file. (ASCI), EBCDIC, WordStar, etc.)

  RAM resident operation for immediate availability, also runs as a standard DOS application—Desk Accessory on the Macintosh

  Moves text across different file formats (DisplayWrite to WordStar, MS Word to WordPerfect, etc.).

  Call or write to order: (VISA, MC, COD, Check)

Microlytics

300 Main St., Suite 1591, East Rochester, NY 14445 (800) 828-6293 (716) 377-0130 In NYS (800) 828-6293

#### **TRANSLATORS**

#### **TRANSLATORS**

Soft. + Docu. FORTRAN IV to C \$474. \$68.
 PLUI (Subset G) to C \$474. \$68.
 CMS-2M to Ada \$521. \$88.
 Generic METAMORPHOSIS \$387. \$34.
 SEND USA CHECK + \$12. \$4 or call for order and data sheets, custom translator quotation and other services.

Rule-driven translator featuring do-it-yourself source and target language definition.

J.H. Shannon Associates, Inc.
P.O. Box 597, Chapel Hill, NC 27514 (919) 929-6863

Inquiry 729.

#### UTILITIES

#### THEY SIMPLY NEVER FAIL MIRROR-DISC SOFTWARE WITH ALTERNATE READ

OPERATING SYSTEMS = XENIX, UNIX, DX10 HARDWARE

- **OPTIONS SPECIFICATIONS**
- = Two discs, Cartridge tape, UPS
  = Data Compression, File optimization
  = THE ULTIMATE DATA INTEGRITY

#### **DISCOM®**

Slotlaan 15, 4902 AD Oosterhout The Netherlands

Inquiry 730.

#### **Enhanced DOS Commands**

Get directory listings of all files that don't match a template. Search all directories for files matching a template. New commands and new versions of existing commands, all with lots of variable options. Plus all commands accept special codes to reduce repetitive en-tries. Get the most from DOS with these time-saving routines. For MS-DOS/PCDOS 2.0 and higher. \$29.95

#### **Driscoll Graphics**

135 E. Church, P.O. Box 625, Clinton, MI 49236

Inquiry 731.

### MATCH PRINTERS TO PC For less than \$30 MatchFont and Match-a-Printer

are great for foreign and scientific writings. Get all the characters you need from most programs and printers (Apple & Epson printers, daisywheels, etc.). Greek, French, Italian, Spanish, German, Swedish, Japanese, graphics... You name it! To receive a FREE demo disk use the inquiry # below or write to:

MATCH SOFTWARE water Canyon, North Hollywood, CA 91606-1113 6426 Coldy

Inquiry 732.

COPY AT TO PC

The 1.2mB drive has long been known to READ but NOT reliably WRITE on 360kB floppies. With "CPYATZPC" II.2mB drives CAN reliably WRITE 360kB floppies saving a slot for a second hard disk or backup tape. "CPYATZPC" (Not Copy Protected) offers "the preferable SOFTWARE SOLUTION: ONLY \$79+54 SH VISA/MCICOD UPS B/R

MICROBRIDGE COMPUTERS
655 Skyway, San Carlos, CA 94070
Order toll free 1-800-523-8777
415-593-8777 (CA)
TELEX EZLNK 62873089
FAX 415-59 212-334-1858 (NY) FAX 415-593-7675

Inquiry 733.

#### The NOVA UTILITIES

Twelve advanced DOS programs that are on every user's wish list. Disk editor, file recovery, point-and-shoot window directory manager, encrypt and compress files, DOS command line qualifiers, find, view, delete, move, copy, more! Less than \$6 per program at only \$69.95 complete with 100+ page manual. MC, Visa Welcome.

NOVA SOFTWARE, Inc.
P.O. Box 37464, Albuquerque, NM 87176 (505) 836-8400

Inquiry 734.

#### UTILITIES

#### Recover deleted files fast!

Disk Explorer now includes automatic file recovery. You type in the deleted file's name, Disk Explorer finds and restores it. Disk Explorer also shows what's really on disk; view, change or create formats, change a files status, change data in any sector. MS-DOS \$75 U.S. Check/Credit card welcome.

QUAID SOFTWARE LIMITED
45 Charles St. E. 3rd Fl.
Toronto, Ontario, Canada M4Y 1S2 (416) 961-8243

#### **LOGGER®**

Logger, for IBM-PC and compatibles, tracks and reports: User, Time on, Time off, Directories used, Programs used, Program start/end time, and calculates totals. Tracks directories/files: Opened, Created, Renamed, Deleted. Completely transparent. Retails for \$74.95 with quantity discounts available.

#### System Automation Software, Inc.

1-800-321-3267 or 1-301-565-8080

Inquiry 735.

#### FasTrieve®

FasTrieve, for IBM-PC and compatibles, indexes your wordprocessing documents to instantly (< 1 your wortphosessing documents to instantly (\(\text{Y}\) resc.) retrieve text using your search expressions (boolean statements, phrases, spelling variations). Retrieved text can be edited, printed, and saved to disk. Retails for \$99. Discounts available.

#### System Automation Software, Inc.

8555 16th St., Silver Spring, MD 20910 1-800-321-3267 or 1-301-565-8080

Inquiry 736.

#### \$79.95!!

Order the RED Utilities now! Programs include: Disk cache speeds hard and floppy disks. Printer spooler. Batch file compiler speeds batch files. Path command for data files. Wild card exceptions. Sort directories. Over 10 more programs. IBM PC. Visa/MC. Send for free catalog.

The Wenham Software Company 5 Burley St., Wenham, MA 01984 (508) 774-7036

Inquiry 737.

#### WORD PROCESSING

#### FARSI / GREEK / ARABIC / RUSSIAN

Hebrew, all European, Scandinavian, plus either Hindi, Pun-jabi, Bengali, Gujarati, Tamil, Thai, Korean, Viet, or IPA. Full-featured multi-language word processor supports on-screen foreign characters and NLQ printing with no hardware modifications. Includes Font Editor. \$355 dot matrix; \$150 add'i for laser; \$19 demo. \$21 hi or U.S. Ind'd. Req. PC, 640K, graphics. 30 day Guarantee. MC/VISA/AMEX

#### GAMMA PRODUCTIONS, INC.

710 Wilshire Blvd., Suite 609, Santa Monica, CA 90401 213/394-8622 Tlx: 5106008273 Gamma Pro SNM

Inquiry 738.

#### PC-Write™ Shareware Ver. 2.71

PC-Write "Shareware Ver. 2.71
Fast, full featured word processor/text editor for IBM
PC. With spell check, screen clip, mailmerge, split
screen, ASCII files, macros. Easy to use. Supports
400 printers - Laser/el+ and PostScript. Software,
User Guide, and Tutorial on 2 disks for \$16. Try it,
then register with us for only \$89 and get User
Manual, 1 year tele-support, newsletter and 2
upgrades. 90-day guarantee. VISA/MC.

**Quicksoft** 1-800-888-8088 CALL TODAY! 219 First N., #224-BYTC, Seattle, WA 98109

Inquiry 739.



# Mail-Order Electronics 24 HOUR ORDER HOTLINE ALL OTHER INQUIRIES (7AM-5PM PST) 415-592-8097 415-592-7108

	Particular Distriction of the Control of the Contro	
<b>NEC V20 &amp; V30 CHIPS</b>	MICROPROCESSOR COMPONENTS	MISC. COMPONENTS
Replace the 8086 or 8088 in Your IBM PC and Part No. Increase Its Speed by up to 30%! Price	MISCELLANEOUS CHIPS 6500/6800/68000 Cont. 8000 SERIES Cont. Part No. Price Part No. Price Part No. Price	TANTALUM CAPACITORS
UPD70108-5 (5MHz) V20 Chip \$ 7.49	D765AC.         3.95         6845.         2.75         8228.         1.95           WD9216.         3.95         6850.         1.95         8237-5.         4.25	TM1/35 .1μf @ 35V19 TM4.7/35 4.7μf @ 35V45 TM1/35 1μf @ 35V19 TM6.8/35 6.8μf @ 35V49
UPD70108-8 (8MHz) V20 Chip \$10.75 UPD70108-10 (10MHz) V20 Chip \$14.95	700 7000 7000 07000 6852 75 8243 175	тмг.2/33 г.гдт @ 35v 25 тмто/35 тодт @ 35v
UPD70116-8 (8MHz) V30 Chip \$11.95	Z80, Z80B, Z80B SERIES         6854         1.19         8250A         4.95           Z80,         1.19         MC68000L8         9.95         8250B (For IBM)         5.95           Z80-CTC         1.29         MC68000L10         11.95         8251A         1.65           Z80-PIO         1.29         MC68010L10         49.95         8253-5         1.95           Z80A         1.29         MC68010L10         49.95         8253-5         1.95	values available (insert onms into space marked "XX"); 500Ω 1K, 2K.
UPD70116-10 (10MHz) v30 Chip \$19.95	ZBO-PIO. 1.29 MC68010L10 195 0251A 155 ZBOA. 1.29 MC68010L10 49.95 8253-5 199 ZBOA-CTC. 1.65 MC680208CEB 99.95 8254 3.95 ZBOA-DDT 4.05 8000 SERIES 8255A-5 2.95	5K, 10K, 20K, 50K, 100K, 200K, 1MEG 43PXX 34 Watt, 15 Turn .99   63PXX 32 Watt, 1 Turn .89
<b>7400</b> Part No. 1-9 10+ Part No. 1-9 10+		
7400	Z80A-Pl01.89 80C319.95 82723.95 Z80A-Sl0/03.95 80351.49 8279-5 2.95	PN2222. 13 PN2907. 13 1N4004. 12 2N2222A. 29 2N4401. 12 1N414807
7402	780B 275 8073 695 8741 995	2 2N2222A 29 2N4401 12 1N4148 07 2N3055 65 1N270 25 1N4755 29 2N3904 12 1N751 15 C10661 49
7405	■ 780R-Pi0 3.05   8085Δ 2.49   8748 (25\/) 7.05	SWITCHES
7407. 39 29 74121. 39 29 7408. 35 25 74123. 49 39 7410. 29 19 74125. 55 45	65022.65 8086-299.95 87499.95	JMT123 SPDT, On-On 1.19   206-8 SPDT, 16-pin DIP 1.29
7414		MPC 121 SPDI, On-Off-On 1.19   MS102 SPST, Momentary .39
741635 .25 74143 4.95 4.85 741735 .25 74150 1.35 1.25 742029 .19 74154 1.35 1.25	6532 5.49 See 5.49 DATA ACQUISITION	D-SUB CONNECTORS DB25P Male, 25-pin .69 DB25S Female, 25-pin .75
742029 .19 74154. 1.35 1.25 743029 .19 74158. 1.49 1.39 743239 .29 7417379 .69	6551. 2.95 8068-2 0.99 ADC0804LCN. 2.75 65C802(CMOS). 15.95 8155. 2.49 ADC0809CCN. 3.65 6800. 1.95 8155-2 3.49 ADC0809CCN. 3.65	I I I I I I I I I I I I I I I I I I I
438 39 29174174 59 49	6802 2.95 8156 2.95 DAC0808LCN 1.75	XC556R T1¾, Red
7445	68211.75 82122.29 AY-3-1015D. 4.95	10.0001/7770
7447	A Like the second was proved by the second s	Low Profile   Miss West (Cald)   1   40
7472	MICROPROCESSOR SALE	8LP
7473	Part No. Pric	e 16LP
7476	8052AHBASIC CPU w/BASIC Interpreter \$24.99 MC68008L8 32-Bit MPU (8-Bit Data Bus) \$9.99	40LP
<b>74LS</b> 74LS00	MC68701 8-Bit EPROM Microcomputer \$14.9	74HCHLSPEED CMOS
74LS00	MC68705P3S 8-Bit EPROM Microcomputer \$9.9	Part No. Price Part No. Price
74LS05	MC68705U3S 8-Bit EPROM Microcomputer \$10.9880286-10 16-Bit Hi Performance MPU \$69.98	74HC02 19 74HC221 89
74LS07	80287-8 Math Co-processor (8MHz) \$244.9	
74LS10 26 16 74LS193 69 59	80287-10 Math Co-processor (10MHz) \$309.95	74HC10
74LS2735 .25 74LS24059 .49 74LS3028 .18 74LS24369 .59	80387-16 Math Co-proc. (16MHz) GRID ARRAY \$474.9:	74HC30
74LS3228 .18 74LS24469 .59 74LS4249 .39 74LS24579 .69		
74LS47 89 .79   74LS259 99 .89	Part No. DYNAMIC RAMS Price Part No. Price	- 74HC76
74LS7435 .25 74LS27949 .39 74LS7539 .29 74LS3223.49 3.39	*4116-15 16,384 x 1 (150ns)	74HC96
74LS76	4128-20 131,072 x 1 (200ns) (Piggyback)3.25 WD17708.95	74HC125
74LS86	*4164-120 65,536 x 1 (120ns)	74HC139 45 74HC4511 1.19
74LS93 49 . 39 74LS373 79 . 69 74LS123 49 . 39 74LS374 79 . 69	*4164-200 65,536 x 1 (200ns). 1,75 6507. 2.9 *MS4416-12 16,394 x 4 (120ns). 7,75 6510. 12.9 *41255-80 262,144 x 1 (80ns). 13.49 6522 2.9.9	5 74HC163
74LS12549 .39 74LS39389 .79 74LS13849 .39 74LS5905.95 5.85	*41256-100 262,144 x 1 (100ns)	
74LS13949 .39 74LS6241.95 1.85 74LS1541.19 1.09 74LS6292.49 2.39 74LS15745 .35 74LS6401.09 .99	*41256-120 262,144 x 1 (120ns)	74HCT00
74LS157 45 35 . 74LS640 1.09	5511000P-10 1,048,576 x 1 (100ns) 1 Meg 39.95   6545-1	74HCT04 19 74HCT174 25
74LS16459 .49 74LS6882.39 2.29	STATIC RAMS 6567	- 74HCT10 · 17 74HCT240 co
74S/PROMS*	*2016-12 2048 x 8 (120ns). 4.49 6569. 15.9 2018-45 2048 x 8 (45ns). 6.95 6572. 10.9 2102 1024 x 1 (350ns). 89 6581 (12V). 12.9	
74S00	2114N 1024 x 4 (450ns)	5 74HCT138
74S08.       .29       74S196.       1.49         74S10.       .25       74S240.       1.39         74S32.       .29       74S244.       1.19	21C14 1024 × 4 (200pg) (CMOS) 49 1 8502	LINEAH
74S74	5101 256 x 4 (450hs) (CMOS) 2.95 8564 4.9 6116P-3 2048 x 8 (150hs) (CMOS) 4.19 8566 9.9 6116LP-3 2048 x 8 (150hs) LP CMOS 5.99 8701 9.9	DS0026CN. 1.95 LM1458N
74S86	"6264LP-12 8192 x 8 (120ns) LP CMOS 10.95	
74S124. 1.49 74S373. 1.49 74S17449 74S374. 1.49 74S17549 74S472*. 2.95	*6264LP-15 8192 x 8 (150ns) LP CMOS 10.25 8722	5 LM309K. 1.25 LM1496N
74F	*43256-15L 32,768 x 8 (150ns) Low Power 15.95 310654-05 9.9	55 LM317T. 65 LM187TN. 1.95 55 LM318N. 99 LM1872N. 1.95 56 LM318N. 1.29 LM1896N-1. 1.49 57 LM319N. 1.29 ULN2003A. 75
74F00	EPROMS 318019-0312.9	5     LM317T.     65     LM187N.     195       LM318N.     99     LM1892N.     195       LM319N.     1.29     LM1903A.     4.49       5     LM323K.     3.49     KP201.     2.95       LM324N.     35     XP2211.     2.95       LM328K.     4.49     XP2243.     1.95       5     LM339N.     39     26LS29.     2.95       LE7477N.     1.49     26LS31.     99
74F04	TMS2516 2048 x 8 (450ns) 25V	5 LM323K. 3.49 XR2206. 3.95 5 LM324N. 35 XR2211. 2.95 5 LM338K. 4.49 XR2243. 1.95
74F10	TMS2564 8192 x 8 (450ns) 25V6.95 325572-01 17.9	5 LM339N. 39 26LS29. 2.95 LF347N. 1.49 26LS31. 99
74F86	1/02A 256 x 8 (1//s) 495 1 001035 01 15 0	EF347N. 1.49 26LS31. 99 5 LM348N. 69 26LS32. 99 5 LM350T. 2.95 26LS33. 1.49 6 LF351N. 39 LM2901N. 2.55 6 LF35SN. 49 LM2901N. 1.29
CD—CMOS	2708 1024 x 8 (450ns) 6.95 901226-01 15.9 2716 2048 x 8 (450ns) 25V 3.75 901227-03 15.9 2716-1 2048 x 8 (350ns) 25V 4.25 901227-03 15.9 27C16 2048 x 8 (450ns) 25V (CMOS) 4.25 901229-05 15.9	55 LM338K 4.49 XR2243 1.95 5 LM339N 39 261.529 2.95 5 LF347N 1.49 261.531 99 5 LM346N 6.9 261.531 9.9 5 LM350T 2.95 261.533 1.49 5 LF351N 3.9 LM290TN 2.5 5 LF35SN 49 LM290TN (6 pin) 1.78 5 LF35SN 79 MC3419CL 3.95 5 LF35SN 79 MC3419CL 3.95 5 LF35SN 79 MC3419CL 9.99 LM358N 49 MC3419CL 9.99 LM358N 49 MC34150C 9.99
CD4001	2/32 4096 X 8 (450ns) 25V	LF355N. 79 LM2917N (8 pin). 1.79 LF356N. 79 MC3419CL 3.95 LF357N 89 MC3446N
CD4008	2732A-20 4096 x 8 (200ns) 21V. 4.25 "Note: 82S100PLA = 2732A-25 4096 x 8 (250ns) 21V. 3.95 U17 (C-64)	IM260N 10E MC3470P1.19
CD4013	27C32 4096 x 8 (450ns) 25V (CMOS)4.95 2764-20 8192 x 8 (200ns) 21V4.25 <b>74CCMOS</b>	LF357N 89 WC3450P 49 MC3450P 49 LM356N 49 WC3470P 119 LM361N 1.95 WC3470P 1.99 LM361N 1.49 WC3471P .99 LM380N-8 99 WC3479P 3.95 LM386h-3 89 WC3485P 99 LM3877 99 LM3870 1.09 LM380N 49
CD4017.       .49       CD40103.       1.49         CD4018.       .59       CD40107.       .49         CD4020.       .59       CD4510.       .69	2764-25 8192 x 8 (250ns) 21V	LM386N-3
CD4020. 59 CD4510. 69 CD4024. 45 CD4511. 69 CD4027. 35 CD4520. 75	2764-45 8192 x 8 (450ns) 21V	9 LM399H
CD403035 CD452279 CD404065 CD453879	27128-20 16,384 x 8 (200ns) 21V	9 TL497ACN. 1.49 LM3916N. 1.49 NE540H (C540H). 99 NE5532 69
CD404929 CD454189 CD405029 CD454379	27128A-25 16,384 x 8 (250ns) 12.5V	5 XRI 555 59   7805K (I M240K 5) 1 20
CD4051	27256-25 32,768 x 8 (250ns) 12.5V	5 LM556N
CD4053 59 CD4553	27512-20 65,536 x 8 (200ns) 12.5V 10.95 740851.49 7409151.3	9 LM567V
CD4067. 1.49 CD4583	27512-25 65,536 x 8 (250ns) 12.5V 9.95 74C86	
CD4069	2816A-25 2048 x 8 (250ns) 5V Read/Write6.25 7409099 7409223.9	5 MC1350P 89 75472
CD4071	2865A-30 8192 x 8 (300ns) 5V Read/Write9.95 74C154 2.95 74C923 3.5 52B13 (21V) 2048 x 8 (350ns) 5V Read Only 1.49 74C173 59 74C925 5.4	MC1398P 495 MC145106P 195
DADTIAL LISTING - OVED 400	O COMPONENTS AND ACCESSORIES IN STOCK! • (	

### Now available...Jameco's NEW 1989 Catalog with 74 pages of Computer Peripherals, Components & More!



#### **RS232 QUICK TESTER**



The QTSS quickly determines the proper RS232 configuration required to interface two peripherals Simply slide the switches and determine by the LEDs which configuration works best.

QTSS..... \$49.95 \$29.95

## JAMECO SOLDERLESS BREADBOARD SOCKETS





JE23	JE	24	JE27		
Part No.	Dim. L" x W"	Contact Points	Binding Posts	Price	
JE20	61/2 x 3/4	200	0	\$ 2.95	
JE21	31/4 x 21/8	400	0	\$ 4.95	
JE22	61/2 x 13/8	630	0	\$ 5.95	
JE23	61/2 x 21/8	830	0	\$ 7.95	
JE24	61/2 x 31/8	1,360	2	\$14.95	
JE25	61/2 x 41/4	1,660	3	\$22.95	
JE26	6% x 5¾	2,390	4	\$27.95	
JE27	71/4 x 71/2	3,220	4	\$37.95	

#### COMPUTER PERIPHERALS

Jameco IBM PC/XT/AT Compatible Motherboards

Award

BIOS ROMs included



JE1001

JE1001 4.77/8MHz (PC/XT)	\$	89.	95
JE1002 4.77/10MHz (PC/XT)	\$1	09.	95
*JE1007 6/8/10/12MHz (AT)	\$2	49.	95
*Limited Quantity Available			

Jameco Computer Power Protection JE1190

JE1190

JE1191



6-Outlet Power Strip . . . . \$11.95 Jameco IBM PC/XT/AT Compatible Keyboards



	Standard Al layout (X1/Al) \$59.95
JE1016	Enhanced layout (XT/AT) \$69.95
9.77	DATA BOOKS

DATA BOOKS					
104100	NSC Linear Data Book-Vol. I (88) \$14.95				
	NSC Linear Data Book-Vol. II (88) \$ 9.95				
104300	NSC Linear Data Book-Vol. III (88) \$ 9.95				
210830	Intel Memory Handbook (88) \$17.95				
	Intel Microsystem Hndbk. Set (88) \$24.95				

#### IBM PC/XT 10MHz Turbo Compatible Kit With 640K RAM

	4.77/10MHz Turbo Motherboard (Zero-K RAM — includes
JE1002	AMI BIOS ROM) \$109.95
JE1014	Turbo Flip-Top Case 69.95
JE1015	XT/AT Compatible Keyboard 59.95 5.25" DSDD Disk
JE1021	Drive (Beige Bezel) 89.95
JE1031	Mini 150W Power Supply 69.95
JE1071	Multi I/O with Controller and Graphics119.95
AMBER	Amber Monitor 99.95
4164-120	Parity RAM (2 chips) 5.90
41256-120	512K RAM (18 chips) 215.10
41464-12	128K RAM (4 chips) 51.80
	Regular List \$892.45

Includes FREE QAPlus Diagnostic Software! AAA

SAVE \$192.50!

NEW

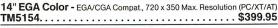
JE3003 IBM Comp. PC/XT 10MHz Turbo Kit \$699.95

#### IBM COMPATIBLE DISPLAY MONITORS

12" Amber Monochrome TL Input, High Resolution (PC/XT/AT) AMBER.....\$99.95 14" RGB Color - CGA Compatible

Amber/Green/Color Switchable, 640 : 200 Resolution (PC/XT/AT)

CTX2410.....\$279.95 CTX2410



14" EGA Monitor and EGA Card - EGA compatible, 720 x 350 Max. lution - displays up to 16 colors (PC/XT/AT)

14" Multiscan Color - VGA/PGC/EGA compatible, 800 x 600 Max. Reso-TM5155....

#### IBM PC/XT/AT COMPATIBLE CARDS

Graphic 5 Display Cards

MasterCard





JE1050	Mono Graphics Card w/Printer Port (PC/XT/AT)	\$59.95
JE1052	Color Graphics Card w/Printer Port (PC/XT/AT)	\$49.95
JE1055	EGA Card with 256K Video RAM (PC/XT/AT)	\$159.95
JE1071	Multi I/O with Drive Controller and Mono Graphics (PC/XT)	\$119.95

#### Multifunction, I/O and Expansion Cards

JE1060	Port and Real Time Clock (PC/XT)
JE1061	RS232 Serial Half Card (PC/XT/AT)\$29.95
JE1065	I/O Card with Serial, Game and Parallel Printer Port (AT)
JE1078	Expand to 384K (zero-K on-board) Multifunc. w/Serial, Game, Parallel Printer Port & Real Time Clock (PC/XT) \$69.95
JE1081	2MB of expanded or extended memory (zero-K on-board) (AT)

JE1082

Floppy and Hard Disk Controller Cards 360KB Floppy Disk Drive Controller Card (PC/XT).... \$29.95 JE1040 20/40MB Hard Disk Controller Card (PC/XT)....\$79.95 JE1041 360K/720K/1.2MB Floppy Disk Cont. Card (PC/XT/AT) \$49.95 JE1043

360K/720K/1.2MB Floppy/Hard Disk JE1045 Controller Card (AT)......\$149.95

U.S. Funds Only Shipping: Add 5% plus \$1.50 Insurance (May vary according to weight)

California Residents: Add 6%, 61/2% or 7% Sales Tax

© 1988 Jameco Electronics 10/88

#### \$20 Minimum Order

IBM is a registered trademark of International Business Machines





#### **COMPUTER PERIPHERALS**

Zuckerboard 30 Meg Hard Disk Drive Board for Tandy 1000, 1000A. 1000SX, 1200, 3000 and 3000HL





• 30 Megabytes formatted capacity • Uses only one slot • Pre-formatted with MS-DOS T30MB 30MB Hard Disk \$599.95 \$399.95



ST225K (Pictured)
MB Drive only (PC/XT/AT) \$224.95
MB w/Controller (PC/XT) \$269.95
MB w/Controller (AT) \$339.95
OMB Drive only (PC/XT/AT) \$249.95
MB w/Controller (PC/XT) \$299.95
MB w/Controller (AT) \$389.95
OMB Drive only (PC/XT/AT) \$429.95
OMB w/Cont. Card (PC/XT) \$469.95
MB w/Controller Card (AT) \$539.95
OMB Drive only (PC/XT/AT) \$499.95
OMB w/Controller (PC/XT) \$549.95
DMB w/Controller Card (AT) \$639.95

### 40MB Tape Back-Up for IBM PC/XT/AT

DJ10 40MB Tape Back-Up. . . . . . \$349.95 40MB Tape Cartridge......\$24.95



Jameco 5.25" PC/XT & AT Compatible **Disk Drives** 

JE1022 (Pictured)

JE1020 360K Black Bzl. (PC/XT/AT) ... \$ 89.95 JE1021 360K Beige Bzl. (PC/XT/AT) ... \$ 89.95 JE1022 1.2MB Beige Bzl. (PC/XT/AT) . . \$109.95

#### 3.5" PC/XT/AT Compatible Disk Drives

MF353B 3.5" 720KB (Bezels and Installation
Kit included) (PC/XT/AT) \$129.95
3.5" 1.44MB (Bezels and Installation
MF355B Kit included) (PC/XT/AT) \$149.95
\$129.95

#### **Datatronics** 2400/1200/300 Modems



NEW, Pocket Version! patible · Auto-dial/auto-answer · FCC approved 1-year warranty · Includes MaxiMite Communication

2000	Soliware (except 1200F)
1200P	1200/300 Baud Pocket Modem \$ 99.95
1200H	1200/300 Baud Internal Modem \$ 69.95
2400S	2400/1200/300 Internal Modem \$129.95
1200C	1200/300 Baud External Modem \$ 99.95
2400E	2400/1200/300 External Modem \$169.95

#### TEST EQUIPMENT



Metex M4650:

• Handheld, high accuracy

• 4½ Digit LCD Manual ranging with Overload

Protection Audible continuity tester

Tests: AC/DC Voltage, Resistance, Continuity Capacitance, Frequency One Year Warranty Size: 7"L x 31/2"W x 11/2"H

M4650 . . . . \$99.95

Prices Subject to Change

Data Sheets - 50¢ each

Send \$2.00 Postage for a FREE 1989 CATALOG

FAX Numbers: 415-592-2503 or 415-595-2664

1355 Shoreway Rd., Belmont, CA 94002 • 24 HR. ORDER HOTLINE 415-592-8097 • All Other Inquiries (7am-5pm PST) 415-592-7108

### INTERFACE CARDS for PC/AT and PS/2



### COMMUNICATION DATA ACQUISITION & CONTROL

FOR A FREE CATALOG CALL

1-800-553-1170



478 E. Exchange St., Akron, OH 44304 TEL: (216) 434-3154 FAX: (216) 434-1409 TLX: 5101012726

Circle 213 on Reader Service Card





#### MODELS 50, 60, 80

- DCE/DTE Selectable
- Transfers to 19.2 K baud
- Address Selectable
- Interrupt Selectable

1-800-553-1170



478 E. Exchange St., Akron, OH 44304 TEL: (216) 434-3154 FAX: (216) 434-1409 TLX: 5101012726

Circle 214 on Reader Service Card

9-Track Tape Drives: Yes! for IBM PC/XT/AT/386 and PS/2



Interchange tapes from mainframes. Important features:

- 800, 1600, 3200, 6250 BPI
- EBCDIC/ASCII conversion
- IBM & ANSI labeled tapes
- · Network backup
- · DOS, XENIX, Microport

 Highest quality customer service For quick delivery we stock all major manufacturers' tape drives, including Cipher, Kennedy, M4 Data, Qualstar.

Prices start at \$3,755. Call Today!

#### Overland Data, Inc.

5620 Kearny Mesa Rd. • San Diego, CA 92111 Tel: (619) 571-5555 • FAX: (619) 571-0982

Circle 190 on Reader Service Card





MODELS 50, 60, 80

- LPT1, LPT2, LPT3
- Optional Serial Port
- OEM Pricing Available

1-800-553-1170



478 E. Exchange St., Akron, OH 44304 TEL: (216) 434-3154 FAX: (216) 434-1409 TLX: 5101012726

Circle 215 on Reader Service Card

RS-422 FOR PS/2



#### MODELS 50, 60, 80

- Two Channel
- Transfers to 256 K baud
- Address Selectable
- Interrupt Selectable

1-800-553-1170



478 E. Exchange St., Akron, OH 44304 TEL: (216) 434-3154 FAX: (216) 434-1409 TLX: 5101012726

Circle 216 on Reader Service Card

#### DYNAMIC RAMS

1MBIT 100ns \$38.00 514256<sub>100ns</sub> \$59.00 41464 150ns \$10.75 41256 100ns \$12.75 41256 120ns \$11.75 41256 150ns

51258 100ns 4164 150ns

\$10.85 \$12.25 \$ 2.95

PROCESSORS 80387-16 16mHz 80287 47 ■E PROMS 27C101 250 80387-16 16mHz 80287-10 10mHz 80287-8 8mHz 80287-6 6mHz 8087-1 10mHz 8087-2 8mHz \$430.00 \$268.00 \$230.00 \$159.00 \$205.00 \$142.00 \$ 99.00 \$ 12.75 \$ 17.00 \$ 8.50

(800) 892-8889 • (800) 882-8181

Circle 117 on Reader Service Card

### **16-BIT RESOLUTION** ANALOG-TO-DIGITAL CONVERTER 12,000 SAMPLES/SEC for IBM PC, XT & AT SINGLE PIECE PRICE \$475

We manufacture a broad line of data acquisition and control hardware and software for Apple and IBM computers.

Call for quotes on custom hardware or complete systems.

LAWSON LABS, INC.

5700 RAIBE ROAD COLUMBIA FALLS, MT 59912 800-321-5355 or 406-387-5355

**IMAGING CARD** 

**GRAY SCALE** 

Composite video in/out 256 x 240 resolution

Digitize/display at frame speed 256 gray levels in

16 Meg. color palette out PC/XT/AT compatible

\$849.00 Complete with software VISA/MC Demo Disk available

**Control Vision** 

P.O. Box 596, Pittsburg, KS 66762 (316) 231-6647

Circle 69 on Reader Service Card

The BEST

Quality 51/4" DS/DD Diskettes Min. 100

Guaranteed Two-for-One Replacement if found initially defective within six months FREE sleeves, tabs, labels

51/4" COLOR (Min. 100) 51/4" HIGH DENSITY (Min. 50) . . . . . 69¢ Brand Box 51/4" (Min. 10) . . . . . . . . . \$3.99 Brand Box COLOR 51/4" with FREE Plastic Case (Min. 10) ... \$4.99 31/2" DS/DD (Min. 50) . . . . . . . .

100% Lifetime Warranty

Shipping: \$4.50 per min. order/\$2.00 each addtl. lot MC/VISA Only

1-800-537-1600 Operator No. 227



Dept. No. 1523 P.O. Box 61000 San Francisco, CA 94161

Circle 161 on Reader Service Card

## LISTINGS Your Way!

It's easy. Now there are three ways to get sourcecode listings that go with BYTE articles—on disk, in print or on line.

LISTINGS ON

**DISK** BYTE listings on disk are right for you if you want to compile or run programs quickly. Also included on disk are the month's BIX highlights specific to your machine format.

LISTINGS IN

PRINT This print supplement contains sourcecode listings described in the issues of BYTE.

## LISTINGS FROM

**BIX** (BYTE Information Exchange) By joining BIX, you can download BYTE source-code listings at standard BIX rates. See BIX informational ad listed in Reader Service index in this issue.



### **FOR DIRECT ORDERING CALL TOLL FREE:** 800-258-5485

Call: M-F, 8:30 a.m. to 4:30 p.m. Eastern Time

(603-924-9281 for New Hampshire residents)

For credit card orders only.

#### ON DISK- \* Including the Month's BIX IN USA: **OUTSIDE USA: Highlights Specific To Your** Machine Format. Single Annual Single Annual Month Subscription Month Subscription Disks of listings from December (one disk) (13 disks) (one disk) (13 disks) 1985 to present are available at the 5¼ inch: □ \$8.95 \$69.95 \$10.95 \$89.95 prices stated at right. Please mark the appropriate format and note (Save \$46.40) (Save \$52.40) ☐ IBM PC\* the issue date below. If you are ☐ Apple II ordering a subscription, please ☐ Kaypro 2 CP/M note the issue date on which you would like it to begin. ☐ MS-DOS 8 Sector\* ☐ TI Professional Month \_\_\_ Year \_\_\_ \$79.95 □ \$11.95 \$99.95 31/2 inch: \$9.95 (Save \$49.40) (Save \$55.40) ☐ Apple Macintosh\* ☐ Atari ST\* ☐ Amiga\* ☐ IBM PS/2\* IN PRINT 1987 Supplement Issues 1986 Supplement Issues IN USA: IN USA: 1988 Supplement Issues ☐ January through March 1987 for ☐ January through June 1986 for only \$6.95. only \$8.95. ☐ January through March

- \$6.95 in USA \$7.95 outside USA
- Monthly supplements replace quarterly supplements starting in April. Indicate the month you're ordering in the space below.

Month \_

\$2.50 per issue in USA \$3.50 per issue outside USA

Annual Subscriptions:

\$19.00 in USA \$22.00 outside USA

Please note month and year you would like the subscription to begin.

Month Year

- ☐ April through June 1987 for only \$6.95. (Includes 1986 Index).
- ☐ July through September 1987 for only \$6.95.
- October through December 1987 for only \$6.95.
- ☐ 1987 subscription only \$18.00.

#### **OUTSIDE USA:**

- ☐ January through March 1987 for only \$7.95.
- April through June 1987 for only
- ☐ July through September 1987 for only \$7.95.
- October through December 1987 for only \$7.95.
- ☐ 1987 subscription only \$21.00.

- ☐ July through September 1986 for
- only \$6.95. October through December 1986
- for only \$6.95.
- ☐ 1986 Annual Subscription for only \$18.00.

#### OUTSIDE USA:

- ☐ January through June for only \$9.95.
- ☐ June through September for only \$7.95.
- October through December for only \$7.95
- ☐ 1986 Annual Subscription for only \$21.00.

### **COMBINED DISK** AND PRINT SUBSCRIPTION

Bundled together, giving you the convenience of diskbased source-code plus the ease of reference of print.

If you are ordering a subscription, please note the issue date on which you would like it to begin.

	IN USA: Annual Subscription	OUTSIDE USA: Annual Subscription	
5¼ inch:  ☐ IBM PC	□ \$89.95 (Save \$58.35)	□ \$109.95 (Save \$75.35)	
☐ Apple II ☐ Kaypro 2 CP/M ☐ MS-DOS 8 Sector ☐ TI Professional			F
3½ inch:  ☐ Apple Macintosh ☐ Atari ST ☐ Amiga ☐ IBM PS/2	□ \$99.95 (Save \$61.35)	☐ \$119.95 (Save \$78.35)	

Please complete in full.	OCTOBER	
Name		☐ Check enclosed
Address		☐ MasterCard ☐ VISA
City	State Zip	
County or Parish	Country	from outside the U.S. please remit in U.S. funds drawn on a U.S. bank. Thank you.)
Credit Card #		
Exp. Date Signature	Date	

Please allow 4-8 weeks for delivery.



FOLD HERE



NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

### **BUSINESS REPLY MAIL**

FIRST CLASS MAIL PERMIT NO. 10 PETERBOROUGH, NH

POSTAGE WILL BE PAID BY ADDRESSEE



One Phoenix Mill Lane Peterborough, NH 03458-9990



FOLD HERE

#### SPECIAL

#### **GENERIC CADD 3.0**

Includes: Auto Dimensioning Dot Plot Drafting Enhancement 1 Drafting Ehnancement 2

\$95

SAVE UP TO 70%

"It PAYS to **BUY! MHI!** 

**SINCE 1984** 

PRODUCTS NOT LISTED ... CALL!

## CAD...etc. PC & MAC

**New Orders:** 1-800-621-3999

**AST Premium** 286/386

Call

SWEET-P 600 6 Pen Plotter \$598

#### **PRINTERS**

AST TurboLaser/PS 3Mb	\$3100
Canon BJ-130	\$689
Citizen 180-D	\$157
MSP-15E	\$295
MSP-40	\$269
MSP-45	\$389
MSP-50	\$345
MSP-55	\$440
Premiere 35	\$439
Tribute 124	
Tribute 224	\$579
Diconix 150	\$299
HP LaserJet II	
JDL 850 Series	
NEC LC890	
Panasonic 1080i-m2	
1091i-m2	
Others	
Toshiba 321-SL	
341-SL	
351-SX	
Others	Cal

#### **MONITORS**

Amdek 1280 & Card		. \$639
210A		\$87
722EGA		. \$431
Hitachi		Call
Cornerstone	 	Call
Mitsubishi Diamond Scan	 	. \$477
Others		Call
Moniterm Viking		Call
NEC Multisync II		. \$565
Multisync GS		. \$185
Others	 	Call
RasterOps 1648s		\$1995
1948s		\$2949
Samsung	 ٠.	Call
Sigma Designs LaserView	 	Call
Sony Multiscan 1303	 	. \$495
Zenith 1490 Flatscreen	٠.	. \$579

#### SOFTWARE

Call (602) 861-1090.

AutoCad															Call
<b>AutoSket</b>	ch														\$59
BoeingG	raph	١.													\$ 195
By-Line															
Carbon C	opy	F	1	U	s										\$ 103
Clipper.															
Copy II P	C.														\$18
Corefast															
Dac Easy	/ 3.0	)													\$58
dBase III	+														\$ 355
DesignC	ad .														\$ 149
Desklink															
DesqVie	w.														\$69
Drafix 1 I	Plus														\$ 149
Drafix 3D	) Mc	od	8	2	C	þ	ot	ic	or	18	,				Call

**ZENITH 1490** 

FlatScreen

\$579

**DESIGN CAD** Standard or 3D

\$149

Dollars & Sense													. \$9	3
Draw Applause													\$26	ô
DDS Back-Up P	lυ	s											. \$3	3
Easy Exral													.\$	5
Excell PC													\$28	3
FastBack													. \$	7
FastBack Plus .													. \$8	3
FormTool													. \$	5
Freelance Plus													\$29	3
Fox Base Plus .													\$17	7
GEM Draw Plus													\$15	5
		7	_	7	_		_	7	_	_	_	_	_	-

#### LIGHTING Disk

SpeedUp Increase your Hard Disk Speed as much as 40%!!! \$69

15 - 14 St. 14 S
Generic Cadd 3.0\$48
Generic Cadd OthersCall
Harvard Graphics\$255
Harvard Tot Proj Mgr \$317
In House Acct\$107
Laplink Plus \$74
Lighting Hard Disk Speedup\$69
Lotus 123 2.01 \$283
Lucid 3d (new Ver.) \$103
Managing Your Money\$113
MathCad 2.0\$199
MS-Dos 3.3\$95
Norton Util 4.0 \$45
PageMaker\$429
Paradox 2.0
PC Tools Deluxe\$35
PathMinder\$55
Peachtree Accounting II\$145
PFS: First Choice\$79
PFS: First Publisher\$52
PFS: Professional File\$129
PFS: Professional Plan\$51
PFS: Professional Write\$102
Plan Perfect
Q&A
Q&A Write\$115
Quattro
Rapid File\$172
R:Base for DOS\$409

#### **CAD CORNER** SPECIAL

ShipMate(tm) (UPS Manifest) ...\$199

SideKick Plus ......Call

AST Premium 286 DiamondScan Monitor Summagraphics 12x12 Plus Intel 80287 Chip

\$3360

Pre-approved P.O.'s are welcome. Prices reflect cash discount and are subject to change without notice. Product com-

patibility, warranties, & claims are responsibility of manufacturer only. All returns are subject to a restocking fee. Per-

sonal/Company checks delay shipping. AZ orders only add 6.7% tax. Orders are processed same Day. International orders

#### DRAFIX

1 Plus or 3D Module

Call

#### **SMART MODEM** 2400B Int.

\$115

Smart Sysmen					.\$418
Sprint					.\$115
Tops					.\$101
Turbo Basic					\$57
Ventura Publishing 1.1					.\$455
VersaCad & Libraries					Call
Windows					Call
WordPerfect 5.0					Call
X-Tree Pro					\$58

#### **DIGITIZERS & PLOTTERS**

Calcon	no 10	123	3-0	16	Г					100		0					0110	c	all
1043																			
Digiti	zers																	C	all
Enter S	wee	t-p	6	00	)												.\$	55	98
Other	rs																	C	all
Housto	n Ins	stru	ım	Θ	n	ts												C	all
DMP	41/4	12																C	all
DMP																			
DMP	51/5	52N	ſΡ									\$	3	32	20	0	12	27	00
DMP																			
DMP																			
DMP																			
DMP	62.																	C	all
MP C	ptio	ns	٠.		•						•							.C	all
	F.,10		•	•	•	•	•	•	•	•	•	•	•	•	•	•		-	_

### HITACHI Digitizer 10 Year Warranty

Includes:

4-Butt Cursor, 1-Butt Pen & Mouse Emulator. \$398

Hitachi (Ten Year Warranty)
HDG-12x12D-4
HDG-12x12D-12 \$486
HDG-15x15D-4 \$598
HDG-15x15D-12 \$659
lolineCall
JDL 850 SeriesCall
Kurta IS 12x12 \$285
IS 12x17\$485
Summagraphics 12x12 Plus\$344
18x12 Pro w/4 Butt & Stylus \$569
Mac Bit Pad 12x12, 4But, Sty \$299

ups manifest \$199

**ShipMate** 

**MITSUBISHI** 

Diamond Scan 40/70 Mb Disk \$439 \$477

### PANASONIC

1091i-m2

\$195

#### DRIVES, MODEMS & FAX

Mitsubishi 40/70 Mb Hard Drive
1/2 ht AT, 23ms \$439
Panasonic FAX Board \$689
Seagate ST225 w/card \$260
ST238 30Mb w/card \$285
Smart Modem 1200B int w/sw \$58
2400B int w/sw \$115
Toshiba 3.5 XT/AT 720k Drive \$89
5.25 XT/AT 360k Drive \$75
US Robotics Courier 2400 \$299

#### **BOARDS & NETWORKS**

Adage AD10/4 \$137
AD10/8L \$204
ArcNet Ca
Artist 8 \$117
10/16 \$192
12 \$232
AST Ca
ATI EGA Wonder \$16
VIP VGA \$24
EtherNet Plus Ca
Genoa VGA 600x800 \$25
VGA 760x1024 \$37
Hercules Graphics Plus \$16
Intel AboveBoard 286/512k \$35
AboveBoard PS 286/512k \$38
Paradise EGA 480 Ca
VGA Plus Ca
VGA Pro Ca
RasterOps Color Draw 24 \$31
ColorBoard 104 \$248
ColorBoard 108 \$116
Sigma Designs VGA \$20
Tops Flashcard\$14
Verticom
Video 7 Vega Deluxe \$17

VENTURA **PUB 1.1 MAKER** \$455 \$429

NOVELL

No-Key \$89

#### COMPUTERS

AST Premium 2	28	6	8	ķ	3	8	6	;				Call
<b>NEC Multispee</b>												
Multispeed E	L	I									\$	1423
Multispeed H	D										\$	2209
Toshiba Laptor												
Accessories												

#### intel coprocessors genuine!

8087-2 (	=8	M	H	z	)						٠.	\$132
80287-8 (	<10	NC	11	lz	:)							\$205
80287-10	(=:	>1	0	M	Ė	12	:)					\$239
80387-16	٠.											\$397
80387-20												\$588
80387-25												. Call
80387SX												. Call

#### MOUSE

Logitech C7 Serial or	ı	3	U	s				\$65
HiRez Bus								\$83
Bus & Paint								\$83
Serial & Publisher								\$ 104
MicroSoft Serial								\$95
PC Mouse								

#### **HELPERS**

Logical Connection 256/512k	Call
OTHERS	
ScanMan	

### NEW! Optical Disk Interface / 40ms

Filesize up to 21 GigaBytes and limited by Disk Only. Speed resembles a 40ms Hard Drive. OptiDriver supports most Optical drives including ATG Gigadisk, ISI 525WC, LMSI LD-1200, Maxtor TXT 800S, Mitsubishi MW-5UI, Optimem 1000, Optotech 5984, Panasonic LF-5000, Ricoh RO-5040WL, Sony WDD-3000. Host Adapters supported include Adaptec, Future Domain, Rancho Technology, Scientific Micro Systems, and Western Digital. Opti-Driver is an applications interface for attaching optical disk drives to an IBM PC/XT/AT or compatible computer system. Low memory usage, approximately 50kb, is required for the master program. NASA is now a proud user of this revolutionary interface. Kit includes OptiDriver, Host Adapter, and Manual. Installs as drive "O" with batch file.

\$525 \$695 list

#### Volume Bids Wecome!

VISA MASTERCARD PO's Just Call First.

MHI Warehouse, Inc. 8129 N. 35th Ave. #2-306 Phoenix, AZ 85051

1-800-621-3999

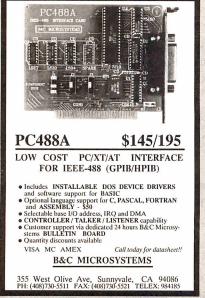
Order Info: 602-997-8877 Fax: 602-943-3833



#### Circle 129 on Reader Service Card



Circle 134 on Reader Service Card



#### Power Software

Batcom — Batch file compiler compiles your ".bat" files to ".exe" files to make them faster, more professional, and more capable. \$49.95.

REDCache — speeds hard disks by up to 7 times and floppy disks by up to 55 times. LIM EMS supported. \$39.95.

Spool — allows you to use your computer while your printer prints long documents. LIM EMS supported. \$39.95.

RED Utilities — Contains the three programs above plus protection from accidental hard disk formatting, sorted directories, text searching, DOS wild card exceptions, and much more. For IBM PC. \$79.95.

Check, COD, Visa, MasterCard.

Wenham Software Co.

5 Burley St.

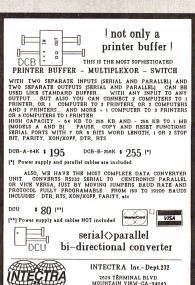
Wenham, Ma. 01984
(508)-774-7036 FREE catalog.

Dealer inquiries invited.

Circle 274 on Reader Service Card



Circle 233 on Reader Service Card



(415) 967-8818 TX 345545



Circle 278 on Reader Service Card

#### "INDISPENSABLE"

**WOODCHUCK INDUSTRIES, INC.** 340 WEST 17 STREET Ste 2B NY, NY 10011 (212) 206-6490 / 924-0576

Jerry Pournelle, Byte, 8/87

Vopt is the fast, safe disk organizer. It will quickly eliminate the file fragmentation that slows your disk operations.

Vopt includes Vmap for viewing the organization of your disks plus numerous other utilities that test and report on the efficiency of your system.

Call for a free demo disk!

\$59.95

\$3 shipping/handling CA add 6.5% sales tax.

**GOLDEN BOW SYSTEMS** 



2870 Fifth Ave., Suite 201 San Diego, CA 92103 800/284-3269

Circle 105 on Reader Service Card



## Compu\$ave

BOARDS	1
Adv. Dig. Slave 545 Orchid Designer 32	9
Alloy Slave599 Panasonic Fax 64	2
AST 4 Port299 Paradise 480 Auto _ 16	9
AST 5251-11E 545 Paradise VGA+ 24	9
AST Hot Shot 286 349 Paradise VGA Pro _ 35	2
ATI VGA Wonder. SAVE STB VGA EM 512K . 29	9
ATI EGA Wonder 195 Sigma VGA H 24	2
BOCA RAM AT 142 Video 7 V RAM 48	5
Genoa VGA HiRes . 392 Video 7 Vega VGA . 25	2
Artist/Computone/Intel/Metheus/Number 9 CAL	L
Quadram/Talltree/West. Digital/Verticom/VML. CAL	L
DISK DRIVES	

CDC 150 Mb 1,445	Seagate 20M Kit 262
Miniscribe 40M295	Seagate 30M Kit 279
Miniscribe 6053 545	Seagate 251 359
Miniscribe 6085 649	Seagate ST251-1 429
PlusCard 20M 518	Seagate 4096 599
PlusCard 40M 655	Toshiba 3.5" Kit 89
AST/Archive/Alloy/Genoa/	lomega/Micropolis CALL
Maynard/Maxtor/Tallgrass	/Tecmar CALI
0.0	****

SOLI	WARE
Carbon Copy+ 5.0 108	Microsoft Word 4.0_ 209
DBase III Plus 374	Multimate Advan. II.249
Fastback Plus 92	Paradox 2.0 429
First Publisher 2.0 75	Quattro 139
Harvard Graph 2.1 . 259	Top for DOS 105
Microsoft Excel/PC. 289	WordPerfect 5.0 239
Microsoft Works 99	Ventura Publisher 495
Peachtree Complete 155	R:BASE for DOS 448

Altos & Other Models.

I ICINIV	IIINALS
Altos V 485	Televideo 965 412
Adds 1010299	Wyse 30 289
IBM 3151 389	Wyse 50 355
Kimtron KT-70 PC 359	Wyse 60 395
Televideo 905 289	Wyse 85G 379
Televideo 955 375	Wyse 99GT 469
Visual/CIE/Link/Qume/Falce	CALL

#### PLOTTERS

Calcomp 1023GT 3785	Houston 62 4495
Calcomp 5902 3395	HP 7475 1395
Calcomp 1044GT . 10,245	HP 7550 A 2895
Enter SP 1800 3095	HP 75957795
Houston DMP 52 2399	loline 3700 3065
Houston 41/42 2110	loline 4000 3995
Houston 56A3850	Roland 980 1195
Houston 61 3025	Roland 880 929
Numonics/Taxan/Versatec/J	JDL/Other Models CALL

#### **DIGITIZERS**

Calcomp12 x12 365	Logitech HiRes Mouse. 92
Calcomp 44 x 60 3745	Kurta IS 3 CALL
Calcomp36 x 48 3195	Kurta IS 8.5 x 11 249
GTCO 24 x36 1945	Kurta IS 12 x 12 315
GTCO 36 x 48 2395	Kurta IS 12 x 17 535
Hitachi 11 x 11 439	Summa 12 x 12 + 355
Logitech C7 Mouse 79	Summa 12 x 18 599

#### MODEMS

WIOD	LIVED
ATI ETC159	Novation Parrot85
Anchor 2400E 145	Practical 1200165
AST 9600779	Prometheus 2400B/2 . 119
Avatex 1200 Ext 95	Prometheus 2400G 149
Hayes 1200 279	Racal-Vadic 2400VP 399
Hayes 2400 415	USR Courier 2400 299
Incomm T2400 235	USR 2400E345
Migent Pocket109	USR HST 9600 649
Multitech 224 EH 388	Ven-Tel 18000 939
Multitech 224 EC 305	Zoom 2400 HC 139
Avatex/Case/Everex/UDS/C	Other ModelsCALL

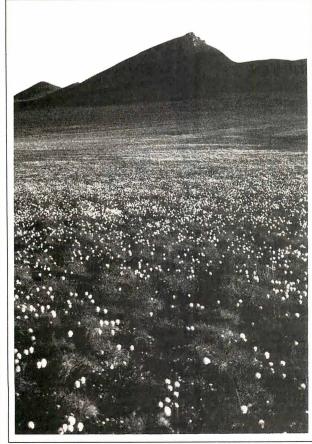
Alps Allegro 24 362 NEC 5300
Alps 324 E 745 NEC P5XL 835
Canon BJ 130 675 NEC P9XL 1038
Citizen120D 142 Panasonic 1080M2 . 165
Citizen 180D 165 Panasonic 1091M2 .191
Citizen MSP40 312 Panasonic 1524 549
Citizen MSP55 489 Panasonic 1595 435
Fujitsu DL3400 512 Star NX1000 173
Okidata 390 464 Toshiba P351SX 935
Okidata 391 645 Canon 8II 1565
NEC P2200 330 NEC LC 890 3165
NEC 5200 519 HP Lazer Jet II SAVE
Brother/C.Itoh/Data Products/Data South CALL
Diconix/Epson/Genicom/QMS/OTC/TICALL

#### **MONITORS**

Amdek 310A 69	PGS LM 300 539
Amdek 1280 645	Samsung TTI 79
ntercolor 19"VGA 1595	Sigma Laser 19" 1765
Mitsubishi 1381A 509	Tatung Multiscan 475
Mitsubishi 20" Auto CALL	Taxan 770+ 515
NEC Multisync II 575	Thomson 4160 RGB 209
NEC Multisync + 915	Thomson EGA 319
NEC Multisync XL_ 2095	Wyse 650 VGA 489
NEC Multisync GS 179	Wyse 700678
PGS Ultra Synch 522	Zenith 1490 598
Seiko 1430: 14", Multiscan,	1024x768, .26mm 649
SCAN	NERS

Datacopy	730	1095	PGS LS-300	w OCR965
AST / HP	/ Taxan / Po	C Han	d Scanner	CALL

HOURS: MON-FRI 7 AM-6 PM, SAT: 9 AM- 2 PM. Address: 4207 S. 37th St. Phoenix AZ 85040, Prices reflect cash discounts and are subject to change without notice. We do not guarantee compatibility. Major credit cards and selected PO's are accepted, RMA required for all returns. ARIZONA SALES: (602)437-4855 - CUSTOMER SERVICE (602)437-4856 - FAX (602)437-9685.



Dennis & Debbie Miller

## The Grand Canyon of the Arctic

In Alaska there's a place as magnificent and rare as the Grand Canyon—the Coastal Plain of the Arctic National Wildlife Refuge. Oil companies want permission from Congress to drill there (even though the odds are four in five that no oil exists). That's like damming the Grand Canyon for hydropower.

Approval to drill will destroy what's left of Alaska's north coast and deny future generations the beauty of our most spectacular Arctic wilderness. To learn how you can help us preserve it, write or call: Sierra Club, 730 Polk Street, San Francisco, CA 94109,



## This could be the most productive phone number you call today. Toll free. (800)531-5369

(Or, if you prefer to FAX your order-1 (512) 344-2985.)

## TrippLite® Battery Back-Ups

Protect your equipment and data by providing safe shut down time for your computer systems and other sensitive equip-

ment during black or brown-outs. Data loss from one black-out can cost you hundreds, if not

thousands of dollars. These units feature AC line spike and noise suppresstatus indicator

239.00

lights and heavy gelcell batteries—a regu-lated battery charger automatically restores BC-200 battery to full charge 200-W when AC power returns.

OMNI Power Director

aaaaa

the market today.

power cord.

TrippLites' ISOBAR command console provides the highest level of surge and

noise suppression of any console unit on

Features include 6 outlets, 5 lighted

power switches, protection indicator power switches, protection indicator power switches, protection and 12-foot light, 15 amp circuit breaker and 12-foot

You can program your own EPROMS with this

You can program your own EPHOMS with this EPROM programmer—it can program up to 4, 16K thru 512K EPROMS simultaneously—easy

You can erase your EPROMS quickly and easily at home or workplace with this easy to use EPROM eraser with built-in timer.

It features an adjustable exposure time with

It features an adjustable exposure time with alarm and is static protected.

\$59.95

to use software is included.

Eprom Eraser

Eprom Programmer





BC-750 750-W



SC-BC-2000 2000-W

This complete TrippLite® Series offers reliable battery back-up at an extremely

9 00 low price.







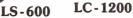
**BC-450** 450-W

TrippLite® Voltage Regulator -**Line Conditioners** 











LC-1800

DB-25 - 25 Line Cables

Male-Male Length

10 ft. 25 ft.

50 ft

100 ft.

\$ 6.95 7.95 17.95

33.95

TrippLite® Line Stabilizer/Conditioners automatically adjust varying input voltage to provide full voltage support during a low voltage condition while suppressing spikes and

### Cable Assemblies







PC/AT Parallel **Printer Cables** 

Stock #	Length	Price	Stoc
PPC301-6	6 ft.	\$ 6.95	25MM-6
PPC301-10	10 ft.	7.95	25MM-10
PPC301-15	15 ft.	11.95	25MM-25
PPC301-25	25 ft.	17.95	25MM-50
PPC301-6RA	6 ft.	12.95	25MM-10

		· · · · ·	
POI	PULA	R CABL	ES

POPULAR CABLES			DB-25 - 25 Line Cables						
Stock#	Description	Price	Male	e-Female	•				
MEC-6	Monitor Ext.	\$5.95	Stock #	Length	Price				
KEC-6	Keyboard Ext.	3.95	25MF-6	6 ft.	\$ 6.95				
ACPC-03	Power Adapter	4.95	25MF-10	10 ft.	7.95				
ATM-6	AT Modem Cable	5.95	25MF-25	25 ft.	17.95				
	ther cables available	0.00	25MF-50 25MF-100	50 ft. 100 ft.	33.95 62.95				

#### Altex Electronics, "Your Electronics Supply House"

TERMS: Minimum order \$10.00. We accept Mastercard, Visa, and American Express at no additional charge. For C.O.D. orders, add \$2.20. For orders under \$100.00, add \$3.00 handling and actual UPS shipping charges. For orders over \$100.00, we pay handling charge—you pay actual UPS shipping charges plus insurance. Purchase orders accepted from approved accounts. All returns require an RMA# and are subject to a restocking fee. Texas residents add 7.5% sales tax. Prices subject to change and we are not responsible for two reapplied error.

Store Hours: 8:00-6:00 M-F, 10:00-2:00 SAT CST 10731 Gulfdale, San Antonio, Texas 78216



Switchboxes



These sturdy metal switchboxes allow you to share computers, printers and other peripherals quickly and easily. They have tected.

DB-25 25 Line Switchboxes Description Lescription
Two position
Three position
Four position
Five position
Six position
Cross over AB25-3 AB25-4 \$19.95 25.95 28.95 38.95

Centronics 36 Line Switchboxes Stock # AB36-3 AB36-4

Description
Two position
Three position
Four position
Five position
Cross over AB36-5 AB36-X 29.95 34.95 44.95 37.95 We carry a complete line of switchboxes for your different requirements. Call for more information!

Without timer (not shown). LA-6A

## **VMEbus** Multibus I&II **S-100** bus

To achieve performance, you need a performance bus. To find out the latest information on any of the above buses, you need

### SUPFRMICRO

the magazine for integrators and users of VME, Multibus, and S-100.

SUPERMICRO, PO Box 2089, Provo, UT 84603

To find out how you can receive a trial issue, circle the number below.

Circle 249 on Reader Service Card



... at your command

Master Switch is sophisticated yet flexible. Several computers can access one another or share printers and modems. Use serial or parallel interfaces, up to nine ports. The buffer is expandable up to one megabyte. Access a job control menu from each computer to view the queue or cancel, hold, and release jobs. Many other features.

MasterNet software allows computer networking and electronic mail capabilities for PCs.

#### Other solutions from ROSE

- Printer Sharing
   Protocol Conversion
   Multiplexers
   Modems
- · Buffering
- Manual Switches
- Micro to mainframe Cables

We design a variety of quality products for computer networking and data communication solutions guaranteed to work. Dealer and OEM inquiries are welcome.



Circle 230 on Reader Service Card (DEALERS: 231)

#### CHIP SHOP

CALL FOR THE **LOWEST PRICES** 

SAME DAY SHIPMENT

4164 8087 80287 4128 41256 80387

, 1 meg chips V20, V30 and more

SABINA INTERNATIONAL, INC. Phone 1-800-2 SABINA Phone 1-714-594-6336 FAX 714-595-4008



UNIVERSAL E(E)PROM PROGRAMMER \$495 (Kits from \$165)

- No personality modules; Menu driven device selection.
- Built-in Eraser/Timer option (\$50); Conductive foam pad.
- Direct technical support; Full 1 year warranty. Stand alone duplication & verify (27XX parts).
- Quick pulse algorithm (27256 under 60 sec).
   27xx to 1 Mbit; 25xx; 68xx; CMOS; EEPROMS.
- 8741,-2,-4,-8,-8H,-9,-9H,-51,-C51,-52,-55, 9761 & more.
- IBM-PC, Apple, CPM or Unix driver; Autobaud RS232.
- Offset/split Hex, Binary, Intel & Motorola 8,16,32 bit.

 Manual with complete schematics. VISA MC AMEX Call today for datasheets!!

#### **B&C MICROSYSTEMS**

355 WEST OLIVE AVE. SUNNYVALE, CA 94086 PH: (408) 730-5511 FAX: (408) 730-5521 TELEX: 984185

Circle 30 on Reader Service Card

#### Dealers!

Network-OS LAN Systems - Includes Boards. Cabling, Terminators and Software. Two-user hardware and software for under \$1,000 list!

Close-Up Remote Communications - Support your customer without leaving your office.
Authored by Cogitate for Norton-Lambert!

Context Sensitive Help for DataFlex, RM/COBOL, Clipper and dBase III - Puts your application's documentation "on line."

DataFlex Database Management - True Multi-User database for MS/PC-DOS, Unix and Xenix. Site licensing available.

Dump/Restore-XT - Seven utilities for the MS/

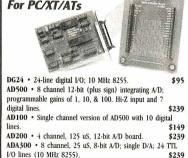
Call or write today for our catalog and pricing!

#### COGITATE, INCORPORATED "A Higher Form of Software

24000 Telegraph Road Southfield, MI 48034 (313) 352-2345/Telex: 386581 Visa/MasterCard Accepted

Circle 56 on Reader Service Card

REAL WORLD I/O



I/O lines (10 MHz 8255). DA600 • Fast settling dual 12-bit D/A. \$169
PD200 • Prototype/development board with address decoder, buffer; 100 + page application/project manual. XB40 • External connection/prototype board with cable. \$49 All boards include BASIC, Pascal, C, and Forth drivers. 30 day return; I year warranty. Call for "Real World

Interfacing" application notes Real Time Devices, Inc. P.O. Box 906 State College, PA 16804 (814) 234-8087

2 Boxes 5 Boxes 10 Boxes

Delaware 1.800.451.1849 Oklahoma 1.800.654.4058 Diskette Nevada 1.800.621.6221 Connection"

TELEX#4933362 FAX#405-495-4598

### OPTICAL DISKS CA

Packed 10/Box 2 Box 5 Box 10 Box MD-2D MD-2HD 1520 1460 1395

~ |295 |260 MF1DD MF2DD ~ | 795 | 765 MF2HD ~ 3995 3900 3775

FD1-1200 ~ 1995 1920 1845 FD 2-1200 ~ 2365 2275 2180

Delaware 1.800.451.1849 Diskette / Oklahoma 1-000 ETHANY, OK. 73008
PO. BOX 1974, BETHANY, OK. 73008
Nevada 1-800-6221
PO. BOX 12396, LAS VEGAS, NV. 69112

Minimum order \$2500 "No Surcharge on Visa Master Card." COD orders add \$300. Surface Shipping UPS add \$300 per 100 for 31/2" or 51/4", add \$400 per 100 for 8." U.S. Mail delivery add 5% "Prices subject to change without Notice"

## Take the byte out of data loss

DataLifePlus & DataLife. 5Box 10Box 2 Box

Double Side Double Density **7**60 **7**<u>30</u> **DataLifePlus** Teflon & PC Formatted 950865

HIGH DENSITY reformatted for AT 1465 1390 1330

10 Box 5Box (Packed 10/Box) 2 Box 1095 " Single Side 195 1150 Double Side 1650 1595

1550 4195 High Density 4295 Delaware 1.800.451.1849

Oklahoma 1.800.654.4058 Diśkette ONNECTION Nevada 1.800.621.6221 TELEX (4933362) -- FAX(405-495-4598)

31	*FREE! Head	
DS-DD .69	Quantity Discounts Available 5.25" 3M Diskettes	DS-HD 1.45
1.49 1.99	3.50" 3M Diskettes	4.45 2.25
.85	8.00" 3M Diskettes 3M Mark Q PC "Form	atted" Disks
.47 .52	3M Highland Box Disk 3M No Logo Bulk, w/	tyvek, labels w/p
DC-2000 3M Mag. Tapes		19.45
1/1 MPA		er 070 14.95 w/keys 14.95
O B		REE Plastic
DS-DD	Quantity Discounts	DS-HD

Available .59\* .89 ... 5.25" BASF Diskettes ... 1.29 .. 3.50" BASF Diskettes ... 4.45 8.00" BASF Diskettes ... 1.99 COLOR-CODED MODULAR FILING CASE/78 FOR \$595 WITH EACH EA. PURCHASE OF 60.

#### BASF 5.25" DS/DD Diskettes!

BASF Mag. Tapes 2400' W-T-S	,				1	1.95
BASF Mag. Tapes 1200' W-T-S	,					7.99
BASF No-Logo 5.25" DS/DD						42

MD2-DMP MD2-HDMP ME2-DDM MOZ-HUMP MF2-DDM 5.25" DS/DD 5.25" DS/HD 3.50"DS/DD .72\* 1.49\*

Verbatim 5.25" DS/DD 5.25" DS/HD 3.50"DS/DD

atalife .72\* 1.30\* 1.49

\*FREE DatalifePlus Offer Inside

COLOR DISKS 5.25" DS/DD 3.50" DS/DD 3.50" DS/HD .72\* 1.59\*



5.25" DS/DD 5.25" DS/HD 3.50"DS/DD

.72 1.49 1.59

CALL FOR BEST PRICES! Box of TEN 5.25" DS/DD

Б	with sleeves, labels and w/p tabs 3.35
Black Dis	ks Color Disks
.29	5.25" DS/HD/48 TPI39
.69	5.25" DS/HD "AT" <b>79</b>
1.09	3.50" DS/HD/135 TPI <b>1.19</b>
	EDEC CLEEVES LADELS AND WID TARS

#### **RIBBONS** STORAGE

-Please call for information-

TERMS: VISA, Mastercard or AMEX. COD only add \$3.00. Prepaid orders deduct 2% cash discount. PO's accepted from recognized institutions and corporations on Net 30. Bank draft, T/T or L/C acceptable. Shipping: \$4/100 or fewer disks. Reduced shipping charges on larger quantities. Price quoted for case (100 disks) quantities less than a case add 5%.

#### **WE BEAT ANY PRICE!**

Toll Free Order Line: Information Line: 1-800-523-9681 1-801-255-0080 TLX-9102404712 FAX-801-572-3327

#### D)

DISKCO TECHNOLOGIES, INC. 213 Cottage Avenue 1339 Sandy, Utah 84091

Motion Control Data Acquisition A card in your PC creates the fast LAB 40 bus which supports up to 8 modules.

User Friendly Packages for PC/XT/AT. User Friendly Packages for PC/XT/AT.

Intelligent DC Servo: Joystick, numeric control, motion record/playback, C calls. Up to 16 axes. Two axis package w/motors \$1550 (USA).

4-Axis Stepper w/source code & motor \$356.

Scope/FFF 650KHz A/D 4 ch. w/source \$525.

Modules: 8 & 12 bit A/D, Relay, Stepper, Clock, Servo & Amps, Prog Controller (Forth, A/D, EEPROM, 68HC11, RS-232/422/485, LAB 40).

Adapter for RS-232 for Mac and others.

\*Free immediate technical support & literature. Call (415) 755-1978 or our BBS (415) 755-1524.

(ontinuum

Telex: 3727438

75 Southgate, Daly City, CA 94015

omputer

(415) 755-1978



Circle 243 on Reader Service Card

#### 9-Track Tape Subsystem for the IBM PC/XT/AT



Now you can exchange data files between your IBM PC and any mainframe or minicomputer using IBM compatible 1600 or 6250 BPI 9-Track tape. System can also be used for disk backup. Transfer rate is up to 4 magabytes per minute on PCs and compatibles. Subsystems include 7" or 101/2" streaming tape drive, tape coupler card and DOS compatible software. For more information, call us today!

### IJUALSTAR

9621 Irondale Ave., Chatsworth, CA 91311 Telephone: (818) 882-5822

Circle 217 on Reader Service Card



Circle 256 on Reader Service Card

#### **UNIPRO**<sup>IM</sup>

UNIVERSAL PROGRAMMER AND MEMORY/TTL IC TESTER FOR PC/XT/AT



E(E)PROM (16K-1MB) PAL (20 & 24 pins) BIPOLAR 8741/42/48/49/50 CPU 87(C)51/44 CPU DYNAMIC/STATIC RAM & TTL TESTER Option: 4 Socket adaptor

only \$585 complete Other products available. Individual programmers for E(E)PROM (up to 1MB), PAL, BIPOLAR, 8748 series, 8751 series, MemoryTTL Tester, and gang programmers with 4, 8, 4 16 sockets. Also industrial quality EPROM Eraser with timer. and safety switch is available (erases 30 of 28 pin eproms at a time).

OEM & Distributor welcome 10% educational discount

473 Sapena Ct. #24 Santa Clara, CA 95054

Order Line - outside CA Tech Line (408) 727-6995 XELTEK M/C AMEY FAX (408) 727-6996

Circle 279 on Reader Service Card

### **OPTICAL DISKS**



as featured in PC WEEK 4/26/88
 800MB storage on single disk

 connecting to any host via SCSI interface

Plug'n Play to any operating system

only \$4995 Limited time only

**PANASONIC LS5000 \$2495** - 200 MB

OPTICAL MEDIA

For IBM & Panasonic Optical Drives - **\$52** 

We carry a full line of 51/4" & 12" Optical Drives

SKAN TEKNOLOGIES, INC. (212) 809-5570 (516)295-2237

Circle 241 on Reader Service Card

#### LOWEST PRICES GUARANTEED

CAT™8MHZ

BASE SYSTEM 256K (Opt. 640K) • 150 Watt Power Supply • AT Style Keyboard Supply • AT Style Keyboard • 4.77 or 8 MHZ Keyboard Selectable

FDC • 8087 Socket • 360K Floppy Drive

\$39900 OPTION A 12" Mono Amber Monitor Graphics Card w/par port

\$54600



10MHZ ADD \$2500

\$71600

COMPLETE SYSTEM CALL FOR PRICE 1 Year Warranty



OPTION C 12" Mono Amber Monitor Graphics Card w/par port 20 Meg Hard Drive \$81900

• 512K Exp. to 1 MEG • 200 Watt Power Supply . AT Style Keyboard Western Digital Controller • 1.2 Meg

- vvestern uigital Controller • 1.2 Meg Floppy • Legal Bios w/manuals • Systems Documentation • 1 yr war. • Clock/Calc

CAT™ 286-10

BASE SYSTEM

OPTION A AT 12" Mono Amber Monitor Graphics Card w/par port

\$107600



COMPLETE SYSTEM CALL FOR PRICE



\$92900

OPTION B AT 640 x 200 Color Monitor Graphics Card w/par por \$129900

CALL

OPTION C AT 12" Mono Amber Monitor Graphics Card w/par port 20 Meg Hard Drive \$139900

### LOWEST

OFF PARALLEL PRINTE	RS BY
6FT CABLE	ON
LX 300199	LQ 500339
LX86E329	LQ850
LX286E 429	LQ1050749
LX800	FX850349
LQ2500	FX1050 499
PANASONIC	CITIZEN

KXP1080I 144CPS ..... 199 **180D** 180CPS 9 Pin 10" . **179 MSP15E** 160CPS 9 Pin 15" **369 MSP40** 250CPS 9 Pin 10" **369** KXP1091I 192CPS KXP1092I 240CPS 379 Tractors — Sheet Feeders — Cables — Ribbons Available

Vega Video 7         17900           Everex EGA 640 x 350         12900           Vega VGA PS2 Compatible         34900           Everex VGA 640 x 400, 17 VGA Modes         24900           Everex PGA 640 x 480, 256/4096 Colors         62900           MEAD Monographics w/par port Hercules comp.         5800           MEAD Color graphics w/par port Hercules comp.         5800
ODD'S & END'S FROM MEAD

**VIDEO CARDS** 

ODD'S & END'S FROM MEAD	
150 Watt Power Supply Direct PC Replacement5400 200 Watt Power Supply Direct AT Replacement7900	
Dos 3.2 w/GW Basic	

TADE BACKLIDG BY

The state of the s	THE RESERVE
Seagate HARD DRIVES  COMPLETE KITS  ST125 20Meg 40 Mil ½ Ht	VARRANT.
COMPLETE KITS NSTRUCTION	'C
ST125 20Meg 40 Mil 1/2 Ht	29900
ST225 20Meg w/cont. & Cables	26900
ST238 30Meg w/cont. & Cables	29900
ST251 40Meg 1/2 HT 40 Mil w/software	37900
ST251-1 40Meg, 28 Mil Sec	
ST277R 60MB 40 Mil 1/2 Ht	
ST4026 20Meg Full Ht 40 Mil	
ST4038 30Meg 40 Mil Full Ht	29900
ST4053 40MB 28 Mil Full Ht	51900
ST4096 80Meg Full HT w/software	64900

MODEMS BY ****EVEREX**
EV-920 EverCom 12 300/1200 bps Bitcom Software 74°0 EV-940 EverCom 24 2400 Baud Int. Bitcom Software . 139°0
EV-945 External 2400 Baud
Hayes Compatible Major Manufacturers
1200 Baud Internal w/Software
2400 Baud Internal ½ card w/software 12900 2400 Baud External Fully Hayes Compatible 12900
2400 Baud External Pully Hayes Compatible

	IALE DACKOLO DI
	EVEREX.
40MB	Mini Cartridge, 1.8MB/min, XT
40MB	Mini Cartridge, 3.6MB/min, AT
40MB	Streaming Cassette, 5MB/min w/cont53900
60MB	Streaming Cassette, 5MB/min w/cont61900
60MB	Streaming Cartridge, 5MB/min w/Full cont 77900
125MB	Streaming Cartridge, 5MB/min w/Full cont 98900
	External Add 19500

	EVEREX-	
OMB OMB OMB OMB OMB OMB 25MB	Mini Cartridge, 1.8MB/min, XT 35900 Mini Cartridge, 3.6MB/min, AT 35900 Streaming Cassette, 5MB/min w/cont 53900 Streaming Cassette, 5MB/min w/cont 61900 Streaming Cartridge, 5MB/min w/Full cont 77900 Streaming Cartridge, 5MB/min w/Full cont 98900 External Add 19500	WX-1 8 WA-2 16 WD-27X WAH 16 RA2 16 MEAD 1 MEAD 1 Hard/Flo
	FLADDY DDIVEC FDAM	

	WESTERN DIGITAL
	WX-1 8 Bit 1/2 Sized for XT 6900
	WA-2 16 Bit Full Sized Hard/Floppy
	WD-27X 8 Bit R11 1/2 Size
	WAH 16 Bit Hard Drive ControllerONLY12900
	RA2 16 Bit R11 Hard/Floppy for AT
	MEAD Floppy Disk Controller for XT
	MEAD 1.2 Meg & 360K Controller for XT 5900
	Hard/Floppy Cable Set
-	000000000000000000000000000000000000000
	COPROCESSORS BY

CONTROLLERS BY

EGA MITERFACE MONITORS BY SAMSUNG			C	DLI IN	0F	200	PR	MONO ICE
SAMSUNG					6	80	O	CE
1252 12" Amber w/Tilt & Swivel Base								7900
1257 12" Amber Flat Screen 720 x 350								8900
1464 14" Color 640 x 200, 16 colors								23900
1453 14" EGA 640 x 350. 64 colors/.31 .		e e						36900
CN4551 Multisync EGA 720x480								47900
IBM CGA/VGA/PGA/EGA Comp	at	ib	le					

	UPPI											í		
rnı	OM YOU	K LUW	P	nıu	E	L		н	υ	С	n	ĺ		
360K 1/2 Ht. I	PC Compa	atible												. 1
1.2 Meg Mits	ubishi Bla	ck Face	0.00		0.00	2000								
720K 31/2" Ep	son Drive	w/51/4"	mo	unti	na	ũ						Ì	Ċ	
1.44 Meg So	ny 31/2" F	rive w/5	1/4 "	mo	ıın'	tir	'n	•	•			•	•	1
COV T	TA4400 0	F.J. III	/4	1110	ull	LII	9	*	•			1		•
360K Tandon	TIVI 100-2	Full Ht.		1111								è	٠	. 1
160K Tandon	TM100-1	Full Ht			223	5						ċ	á	. !

COLUCTOSOUS DI	
INTEL	
Intel 8087 5Mhz 9	900
Intel 8087 8Mhz	900
Intel 8087 8Mhz	900
Intel 80287 8Mhz	900
Intel 80287 10Mhz	900
Intel 80387 16Mhz42	900
Intel 80387 20Mhz	900
	-

## OVERSTOCKED AT OUT COST

### LETTER QUALITY PRINTER

DAISYWHEEL PRINTER MANUFACTURED BY C.ITOH

Why pay \$1149 for a C.Itoh STARWRITER™ F-10

When our 40 cps letter quality daisywheel printer from the same manufacturer is only

ea.

100 for \$2

A Company of the Comp	
1	049050
249 ea	

100			
	1000000	 	
	1		
	679	 and the second second second second second	90"
249 e	a		

49	ea.
	STANDARD FEATURES
L	OCPS • Accepts Paper to 15 inches • Form ength and Pitch Set from Conrol Panel dustry compatible ribbon, printwheels and

## RAM UPGRADES YR. WARRANTY



41256 100 NS 12 <sup>75</sup>	Simm Sipp Zipp 256 x 9 100 NS12900
41256 80 NS	256 x 9 100 NS12900
4464 150 NS 1395	256 x 9 120 NS 11900
1Meg x 1 120 NS 3700	1Meg x 8 120NS 44900
1Meg x 1 100 NS 3900	1Meg x 9 120NS 49900

OPTIONS	
6 ft. Serial Cable     AT or XT RS232/Serial Interface     Bidirectional Tractor     Cut Sheet Feeder.	3900

10 MEG HARD DISK KIT

Includes Controller & Cables
• ½ Height • 80 Msec
Brand New/Major Manufacturer

Mead 15900

## control commands . RS232 Serial Interface

AT COMPATIBLE Full Height • 40 Msec
• 30 Day Warranty

### **40 MEG HARD DISK**

10 for 24900 ea Mead 27900

### ......1175 MOUSE

325 41256

345 4464

1145

MICROSOFT COMPATIBLE • 3 Button

 Mechanical w/Software
 Serial Mead 2900

#### TAPE CASSETTE/CARTRIDGE

DC1000, 3M....9°° DC300XCL 45Meg..14°° DC300A Used..7°° CJ500......19°° CJ600.....24°°

800-654-7762

SALES: 7 a.m.-6 p.m. PST

702-294-0204

CUSTOMER SERVICE / ORDER STATUS: 9 a.m.-4 p.m. PST

FAX 702-294-1168

Circle 155 on Reader Service Card

Trademarks are Registered with their respective Co.s. Prices Subject to Change



1000 Nevada Hwy. . Unit 101 . Boulder City, NV 89005

4164

4164 4164

41256

41256 120 NS

150 NS 120 NS

100 NS 150 NS

NO SURCHARGE FOR MC/VISA

TERMS:

MC . VISA . COD . CASH Purchase Orders from Qualified Firms Personal Checks • AE add 4% 20% Restocking Fee on Non-Defective Returns







SHIPPING: (min. 625) UPS



Circle 286 on Reader Service Card



Circle 158 on Reader Service Card

### **HD64180 Single Board** Protyping / Control Computer Get your 64180 project going quickly!



The SBC100 is a complete computer powered by a wall transformer. Available C compiler, assembler, linker and debugger run on a PC. Has battery-backed RAM, battery-backed clock, power fail interrupt, SBX bus connectors, serial and parallel I/O, prototype area for up to 20 IC's. Only \$295 including serial cable, power supply, 32k of battery backed RAM and schematics.

Z-World

1772A Picasso Avenue Davis, CA 95616 (916) 753-3722



"Z80 Family Specialists"

In Germany: iSystem 08131/1687

### HARD DISK CONTROLLERS

mine pien deminerante
ADAPTEC
PC/XT Controller ST506/412
2070 PC/XT to 506/412 RLL
2071 PC/XT to ST506 RLL (1 drive)
2072 PC/XT RLL\$79
2370 PC/XT to ST506 RLL
3530 SCSI to Tape CMC 36\$78
4000 SCSI to ST506/412
4000A SCSI to ST506/412
4070 SCSI to ST506/412 RLL
4520 SCSI to ESDI
5500 SCSI to ST506/412
5580 SCSI to SMD\$175
XEREC
S1410 SASI Controller
S1420 SASI to 51/4" Floppy & Hard Disk Controller \$29
Apple II, II+, IIE Host Adapter\$29
OTHERS
DTC 510A SASI controller
DTC 510A SASI controller
Konan DJ-210 3½" SASI to ST506/412
(Xebec 1410 clone)
Western Digital 1003WAH\$119
Manuals\$8 each
Cables Available Ask for Pricing
Hard Drives 20-380 MBCall
@ Commuten Cumulus Gione
Computer Surplus Store
715 Sycamore Dr. • Milpitas, CA 95035
Phone: 408-434-1060
Fax: 408-434-0931
Twx: 1561447
"We Buy and Sell"

Circle 66 on Reader Service Card



Circle 159 on Reader Service Card

## for Z80 and HD64180 Microprocessor Programming.

Source level debugging on a remote target!

Investigate our powerful PC-based, C compiler for embedded Z80 and HD64180 microprocessors... a compiler written for microprocessor engineers. Only \$495.00.

- · Remote source debugger. \$195.00.
- Additional products: assemblers, linkers, single board computers.

**Z-World** 1772A Picasso Avenue Davis, CA 95616 916 753-3722 Fax: 916 753-5141



In Germany: iSystem Tel: 08131/1687 "Z80 Specialists"

Circle 285 on Reader Service Card



### **OPERATING** SYSTEM **UNDER \$20**

#### F68HC11 = MC68HC11 + MAX FORTH

LOW COST ★ LOW POWER CMOS ★ SINGLE CHIP OR EXPANDED OPERATION ★ HLL RESIDENT FORTH \* FAST DEBUG \* 5
PARALLEL \* 2 SERIAL \* WATCH DOG TIMER
\* 8 CH OF 8 BIT A/D \* SUPPORTS RS232, 422, 485. F68HC11 OPERATING SYSTEM UNDER \$20 AT 1K PCS. NMIX0022PS —
COMPLETE DEVELOPMENT SYSTEM WITH MANUALS \$265. VISA-MC ACCEPTED.

#### **NEW MICROS INC.**

1601 CHALK HILL RD. DALLAS, TX 75212 214/339-2204

Circle 185 on Reader Service Card

## PROMPT DELIVERY!!! SAME DAY SHIPPING (USUALLY) OUANTITY ONE PRICES SHOWN for AUG. 9, 1988

#### OUTSIDE OKLAHOMA: NO SALES TAX DYNAMIC RAM NIMIZ 1Mbit 100 ns 1048Kx1 38.50 60 ns 14.25 256Kx1 41256 256Kx1 80 ns 41256 256Kx1 100 ns 13.50 51258 100 ns 12.95 \* 256Kx1 41256 120 ns 256Kx1 12.75 6Kx1 150 ns 4Kx4 120 ns **EPROM** 41256 256Kx1 11 75 41264 + 64Kx4 18.95 **27C1000** 128Kx8 200 ns **27C512** 64Kx8 200 ns \$37.50 27C512 27256 250 ns 250 ns 32Kx8 7.25 27128 6.60 STATIC RAM 32Kx8 100 ns 43256L-10 32Kx8 \$18.95 6264P-12 8Кх8 120 ns OPEN 61/2 DAYS, 7:30 AM-10 PM: SHIP VIA FED-EX ON SAT.

## WE EXPORT ONLY TO CANADA, GUAM, PUERTO RICO & VIRGIN ISLANDS SAT DELIVERY MasterCard/VISA or UPS CASH COD

n: Std Air \$6/3 lb :: P-1 \$10.25/1 lb

MasterCard/VISA or UPS CASH COD Factory New, Prime Parts ⊥P∞ (918) 267-4961

Circle 169 on Reader Service Card

## 9-TRACK MAG. TAPE SUBSYSTEM\* FOR THE IBM PC/XT/AT AND...



For information interchange, backup and archival storage, AK Systems offers a 9-track, IBM format-compatible ½" magnetic tape subsystem for the IBM PC, featuring:

- IBM format 1600/3200 and 800 cpi.
- Software for PC-DOS, MS-DOS, XENIX
- Also for AT&T, DEC, VAX, VME, S-100, RS-232, IEEE 488. \* formerly IBEX Ma

**AKS**ystems

Circle 13 on Reader Service Card

**ORDER DESK ONLY** 

Continental U.S.A (800) 872-8878

Inside California (800) 223-9977 L.A. & Technical Info (213) 217-8912

**OEM INQUIRIES** WELCOME

LIQUID CRYSTAL DISPLAY

Physical size 31/6"L x 13/6"W x 1/4"D



2 for \$25

\*ADAPTEC 4000A CONTROLLER

I/O for the ST412-506 Interface Using MFM Encoding

**\*DC 600 STYLE TAPES** 10+

10,000 ftpi

ea. 19.95

3-9 17.95 ea.

★ 1.2 MB-OKIDATA

Reads/writes 360K • Half Height floppy for AT. 1.2 MB • DS/DD • 96 tpi



INCREDIBLE!

**MEMORY EXPANSION CARD** FOR YOUR IBM PC/AT

Can be expanded to 2Mb memory. This card can do EMS and EEMS as well as extended memory. We bought these bulk pack from an OEM, so no AST box or manual. We supply our own manual. Comes with software for printer spooler and Ramdisk. 1 year warranty. RAMPAGE™ card available with O-K memory only. Serial/parallel port card available separately at a very good price.

ROBOTIC LENS with infrared sensors (auto focus)
A HOBBYISTS DREAM

Great source of optical and electro-mechanical parts and systems

Including the basis for an infrared communications system.

Contains f1.4 - 12 to 72 mm (6x) zoom lens with auto focusing capability.

DC motor driven or manual zoom and focus systems with precision gear reduction units, mechanical clutches, and high quality DC motors. DC rotary actuator controlled iris diaphram unit.

Option Available: Infrared distance measuring system (focusing unit) with control electronics \$10.00

(focusing unit) with control electronics \$10.00.

7" DIAGONAL HIGH RESOLUTIO SCREEN

IN BOX

22 MHZ TYPICAL **BANDWIDTH** 

- Flat faceplate
- 900 lines at center 650 lines at corners
- Operates from 12VDC at 1.4 amp
- Vertical input is 47 to 63 Hz
- Horizontal frequency: 15 Khz (adjustable)



4 for \$99.00 For split video (TTL inputs) operation. Not composite video.

**DISPLAY MODES VGA GRAPHICS:** 

800 x 560 x 16 colors 320 x 200 x 256 colors







### VGA COLOR GRAPHICS PACKAGE

#### ALSO:

640 x 480 x 16 colors

640 x 350 x 16 colors

640 x 200 x 16 colors

640 x 200 black & white

320 x 200 x 4 colors

Hercules Graphics 40 and 80 column character mode

The manufacturer of this monitor SET THE STANDARD FOR COLOR GRAPHICS. The card is an ATI improved VIP CARD. The package comes with user friendly manual and step-by-step instructions. One year warranty on the monitor, two year warranty on the card.

CALL FOR QUANTITY DISCOUNTS.

- 13" color screen
- Max resolution (800x560)
- Bandwidth: 17 Mhz
- Software selectable to VGA. EGA. CGA, MDA, HGA
- Anti-reflective, coated non-interlaced flicker free screen
- .31 dot pitch



1490 W. ARTESIA BLVD, GARDENA, CA 90247

Continental U.S.A.

(800) 872-8878

Inside California (800) 223-9977



L.A. Area & Technical Info. (213) 217-8912

15% Restocking fee for returned orders.

NO SURCHARGE FOR CREDIT CARD ORDERS!

Minimum Order: \$25.00. Shipping & handling charges via UPS Ground: \$.50/lb. UPS Air: \$1.00/lb. Minimum Charge: \$4.00. We accept cashiers checks, MC or VISA. No personal check COD's. California residents add 61/2% sales tax. We are not responsible for typographical errors. All merchandise subject to prior sale. Phone orders welcome. Foreign Orders require special handling. Prices subject to change without notice.

## OS SOURCE

The XT BiosKit is a 270 page book with a diskette containing source code in C, plus utility programs to help you create a Bios. Now you can have a Bios with documentation for your own applications: modify boot-up, eliminate the keyboard, install security features, etc. Only \$99 complete. The AT Bios Kit is only \$199, or get both Bioskits

#### XT-AT HANDBOOK

The XT-AT Handbook is full of hardware and software information in a shirt pocket size book. Over 70 pages covering 38 subjects, including connectors. I/O maps, controller programming, DOS and DEBUG commands, board dimensions, character codes, hard disk drive types, and much more. Only \$9.95 each qty 1-4, five or more, \$5 each. VISA

#### Annahooks

12145 Alta Carmel Ct. 250, Suite 262 San Diego, California 92128 (619) 271-9526

Circle 21 on Reader Service Card

### **EPROM PROGRAMER**

FOR PC \$129,95



- 2716 to 1 MEG
- Updateable to 32 MEG
- Programs 2764 A in 10 Seconds
- . Menu Driven Software
- External 40 PIN ZIF (PC only) Adapter 8748, 49, 51, 52, 55, TMS 7742
- \$50 PC only 1 Year Warranty

tified

- 10 Day Money Back Guarantee
  Available for APPLE II \$92.50
  For More Information Call

VISA MC

**NEEDHAM'S ELECTRONICS** 4535 Orange Grove, Sacramento, CA 95841 (916) 924-8037 (M-F) 8 AM to 5 PM PST

Fix common problems fast!

You don't need to be an expert

problems involving PC setup.

All vou need is HELPME™

software! More than 300 tests. On-screen help for understanding and correcting idenproblems.

identification of system con-

figuration and compatibility.

\$99 plus shipping and han-

dling. MC and VISA accepted.

California Software Products,

Inc., 525 N. Cabrillo Park Drive,

diagnose and correct

Circle 183 on Reader Service Card

### Satellite Communication

Circle 198 on Reader Service Card

### MICROSAT II

**Make Money** 

With Your PC

A Revolutionary Software System, de-

signed for maximum profits with min-

imum setup, now transforms any IBM

PC/XT/AT or compatible computer into

a secure, reliable Bulletin Board and Infor-

Subscription Systems throughout the

free world are presently being used in dial-

a-date and matchmaking applications, for

multi-user databases and multiple listing

endeavors, on-line order taking, along with

scores of other lucrative telecommunica-

To learn more about this unique, self-

perpetuating opportunity that can adapt to

both voice and data environments, contact:

PC/WORKS at (805) 654-0721 or FAX

mation Host System.

tions tasks.

(805) 650-0195.

**Expansion Board** 



- For IBM PC/XT/AT and compatible.
- Satellite data receiver 9600 baud.
- Satellite bulletin board.
- · Satellite video and audio option - Add \$200

PERSONAL SPACE COMMUNICATIONS

707 Johnson Road, Blaine WA 98230 FAX (604)597-6214 16041597-6298 TLX 04-508306

Circle 201 on Reader Service Card

## 8051 FAMILY EMULATORS



Austria	02 22 38 76 38
Australia	02 654 1873
Denmark	02 65 81 11
Finland	See Sweden
France	01 69 412 801
Great Britain	01 464 2586
Israel	03 499034
Korea	02 784 7841
New Zealand	04 886 375
Norway	See Sweden
Portugal	01 83 56 70
Spain	03 217 2340
Switzerland	01 740 41 05
West Germany	08 131 16 87
Sweden	040 92 24 25
U.S.A	408 866 1820

#### noHau CORPORATION

51 E. Campbell Ave., #107E Campbell, CA 95008 (408) 866-1820

Circle 184 on Reader Service Card

## **RAMCHECK®**



ONLY \$249 (Reseller 1-\$199; 2-\$179) Stop throwing away suspected memory chips. With today's high memory chip prices you can easily justify RAM-CHECK's cost after testing only 20 memory chips. RAMCHECK boasts a built-in 8088 powerful processor for testing every cell of a 64K/256K DRAM chip in just 2.3 seconds. Thousands sold worldwide. ... an indispensable tool for handling memory chips."

Made in USA By: [[N]NOVENTIONS, Dinc.

(713) 879-6226 10804 Fallstone Rd., Suite 214, Houston, TX 77099

Circle 47 on Reader Service Card (DEALERS: 48)

Santa Ana, CA 92701

(714) 973-0440.

### PAL/EPROM PROGRAMMER CARD

NEW -- VERSION 2 OF SOFTWARE AND HARDWARE

-Programs 20 and 24 Pin MMI, NS, TI, AMD, ALTERA, CYPRESS, RICOH, and PANATEC PALS. Supports EPLD, polarity, RA, and shared polarly, NA, and shared product term types.
-Functions Include: Read, Write, Verify, Protect, Edit, Print, and File load and save of program.
-JEDEC supported.
-Software Included



100MHZ LOGIC ANALYZER CARD For PC/XT/AT Systems



-24 Channels at 25Khz-25Mhz -6 Channels at 100 Mhz -Internal Clock up to 100 Mhz -External Clock up to 25 Mhz -Threshold Voltage TTL, ECL, or variable from -10 to +10v Can Stack Multiple Boards
 All Software Included

CALL NOW FOR ORDERS AND TECHNICAL INFO (201) 994-6669



Link Computer Graphics, Inc. 4 Sparrow Dr., Livingston, NJ 07039. TLX: 9102409305 LINK COMPUTER

Circle 141 on Reader Service Card

#### Terminal Emulation

#### TEK 4105 EM4105 \$349

- Tektronix 4105
- Tektronix 4010 VT220, VT102
- Picture files
- VGA and EGA support
- High resolution hardcopy

### VT220 EM220 \$169

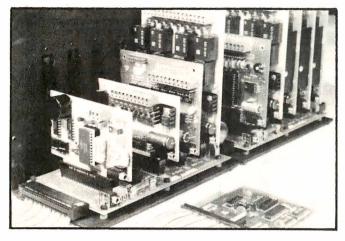
- VT220, VT102 emulation
- · File transfer
- 132 column modes
- Color support
- · Hot key

#### Diversified Computer Systems, Inc.

3775 Iris Avenue, Suite 1B Boulder, CO 86301 (303) 447-9251 FAX: 303-447-1406

Trademarks: VT102, VT220 -- DEC; Tektronix — Tektronics Inc.

## The Amazing A-BUS



An A-BUS system with two Motherboards
A-BUS adapter (IBM) in foreground

#### Plug into the future

With the A-BUS you can plug your PC (IBM, Apple, TRS-80) into a future of exciting new applications in the fields of control, monitoring, automation, sensing, robotics, etc.

Alpha's modular A-BUS offers a proven method to build your "custom" system today. Tomorrow, when you are ready to take another step, you will be able to add more functions. This is ideal for first time experimenting and teaching.

A-BUS control can be entirely done in simple BASIC or Pascal, and no knowledge of electronics is required!

An A-BUS system consists of the A-BUS adapter plugged into your computer and a cable to connect the Adapter to 1 or 2 A-BUS cards. The same cable will also fit an A-BUS Motherboard for expansion up to 25 cards in any combination.

The A-BUS is backed by Alpha's continuing support (our 11th year, 50000 customers in over 60 countries).

The complete set of A-BUS User's Manuals is available for \$10.

#### About the A-BUS:

 All the A-BUS cards are very easy to use with any language that can read or write to a Port or Memory. In BASIC, use INP and OUT (or PEEK and POKE with Apples and Tandy Color Computers)

They are all compatible with each other. You can mix and match up to 25° cards to fit your application. Card addresses are easily set with jumpers.

 A-BUS cards are shipped with power supplies (except PD-123) and detailed manuals (including schematics and programming examples).

Relay Card RE-140: \$129

Includes eight industrial relays. (3 amp contacts. SPST) individually controlled and latched. 8 LED's show status. Easy to use (OUT or POKE in BASIC). Card address is jumper selectable.

Reed Relay Card

RE-156: \$99

Same features as above, but uses 8 Reed Relays to switch low level signals (20mA max). Use as a channel selector, solid state relay driver, etc.

Analog Input Card AD-142: \$129
Eight analog inputs. 0 to +5V range can be expanded to 100V by adding a resistor. 8 bit resolution (20mV). Conversion time 120us. Perfect to measure voltage, temperature, light levels, pressure, etc. Very easy to use.

12 Bit A/D Converter AN-146: \$139
This analog to digital converter is accurate to .025%. Input range is —4V to +4V. Resolution: 1 millivolt. The on board amplifier boosts signals up to 50 times to read microvolts. Conversion time is 130ms. Ideal for thermocouple, strain gauge, etc. 1 channel. (Expand to 8 channels using the RE-156 card).

Digital Input Card IN-141: \$59
The eight inputs are optically isolated, so it's safe and easy to connect any "on/off" devices, such as switches, thermostats, alarm loops, etc. to your computer. To read the eight inputs. simply use BASIC INP (or PEEK).

24 Line TTL I/O DG-148: \$65
Connect 24 input or output signals (switches or any TTL device) to your computer. The card can be set for: input, latched output, strobed output, strobed input, and/or bidirectional strobed I/O. Uses the 8255A chip.

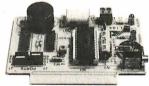
CL-144: \$89
Powerful clock/calendar with: battery backup for Time, Date and Alarm setting (time and date); built in alarm relay, led and buzzer; timing to 1/100 second. Easy to use decimal format. Lithium battery included.

**Touch Tone® Decoder** PH-145: \$79
Each tone is converted into a number which is stored on the board. Simply read the number with INP or POKE. Use for remote control projects, etc.

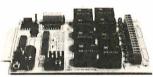
A-BUS Prototyping Card PR-152: \$15 3½ by 4½ in. with power and ground bus. Fits up to 10 l.C.s



ST-143



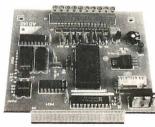
CL-144



RE-140



IN-141



AD-142

Smart Stepper Controller SC-149: \$299

World's finest stepper controller. On board microprocessor controls 4 motors simultaneously. Incredibly, it accepts plain English commands like "Move arm 10.2 inches left". Many complex sequences can be defined as "macros" and stored in the on board memory. For each axis, you can control: coordinate (relative or absolute), ramping, speed, step type (half, full, wave), scale factor, units, holding power, etc. Many inputs: 8 limit & "wait until" switches, panic button, etc. On the fly reporting of position. speed, etc. On board drivers (350 mA) for small steppers (MO-103). Send for SC-149 flyer.

Remote Control Keypad Option RC-121: \$49
To control the 4 motors directly, and "teach" sequences of motions.
Power Driver Board Option PD-123: \$89

Boost controller drive to 5 amps per phase. For two motors (eight drivers).

Breakout Board Option BB-122: \$19

For easy connection of 2 motors, 3 ft, cable ends with screw terminal board

Stepper Motor Driver ST-143: \$79
Stepper motors are the ultimate in motion control. The special package (below) includes everything you need to get familiar with them. Each card drives two stepper motors (12V, bidirectional. 4 phase. 350 mA per phase).

Special Package: 2 motors (M0-103) + ST-143: PA-181: \$99

**Stepper Motors** MO-103: \$15 or 4 for \$39 Pancake type, 2¼" dia, ¼" shaft, 7.5°/step, 4 phase bidirectional, 300 step/sec, 12V, 36 ohm, bipolar, 5 oz-in torque, same as Airpax K82701-P2.

Current Developments

Intelligent Voice Synthesizer, 14 Bit Analog to Digital converter, 4 Channel Digital to Analog converter. Counter Timer, Voice Recognition.

A-BUS Adapters for:

A DOS Adapters for.	
IBM PC, XT, AT and compatibles. Uses one short slot.	AR-133\$69
Tandy 1000, 1000 EX & SX, 1200, 3000. Uses one short slot.	AR-133\$69
Apple II, II+, IIe. Uses any slot.	AR-134\$49
TRS-80 Model 102, 200 Plugs into 40 pin "system bus".	AR-136\$69
Model 100. Uses 40 pin socket. (Socket is duplicated on adapter).	AR-135\$69
TRS-80 Mod 3,4,4 D. Fits 50 pin bus. (With hard disk. use Y-cable).	AR-132\$49
TRS-80 Model 4P. Includes extra cable. (50 pin bus is recessed).	AR-137\$62
TRS-80 Model I. Plugs into 40 pin I/O bus on KB or E/I.	AR-131\$39
Color Computers (Tandy). Fits ROM slot. Multipak. or Y-cable.	AR-138\$49

A-BUS Cable (3 ft, 50 cond.) CA-163: \$24
Connects the A-BUS adapter to one A-BUS card or to first Motherboard.
Special cable for two A-BUS cards: CA-162: \$34

A-BUS Motherboard MB-120: \$99
Each Motherboard holds five A-BUS cards. A sixth connector allows a second Motherboard to be added to the first (with connecting cable CA-161: \$12). Up to five Motherboards can be joined this way to a single A-BUS adapter. Sturdy aluminum frame and card guides included.

Add \$3.00 per order for shipping. Visa, MC, checks, M.O. welcome. CT & NY residents add sales tax. C.O.D. add \$3.00 extra. Canada: shipping is \$5 Overseas add 10%



ALPHA Products
242-B West Avenue, Darien, CT 06820

Technical info: (203) 656-1806 Orders only Except in CT 800 221-0916 Connecticut orders: (203) 348-9436 All lines open weekdays 9 to 5 Eastern time



- 1. Same Day Service All orders shipped, insured, within 24 hrs
- 2. Guaranteed Satisfaction Lifetime warranty, 30-day return guarantee
- 3. In-stock Inventory No delays, no disappointments
- 4. No Minimum Order Quantity discounts also available
- Pre-Approved Purchase Orders and Visa & Master-Card Accepted

#### AND GREAT PRICES!

5.25 Black Disks, DS/DD	.36 ea.
5.25 Color Disks, 8 Colors	
Available, DS/DD	.46 ea.
5.25 Black Disks, DS/HD.	.82 ea.
5.25 Color Disks, 8 Colors	
Available, DS/HD	.94 ea.
3.5 Blue or Gray Disks,	
DS/DD	1.12 ea.
3.5 Color Disks, 5 Colors	
Available, DS/DD	1.28 ea.
3.5 High Density, Black	
only	3.80 ea.

100% certified and tested. Error free lifetime warranty. All disks include generic white box, Tyvek sleeves, labels, write protect tabs, shrink wrapped.



#### CONTINUOUS FORM LABELS

Size	Across	Box Qty.	Price/1,000
23/4 x 7/16	1 across	10,000	\$1.95
23/4 x 7/16	4 across	20,000	\$1.95
21/2 x 15/16	1 across	5,000	\$2.18
21/2 x 15/16	3 across	15,000	\$1.98
23/4 x 23/4*	1 across	2,500	\$12.00
23/4 x 1-7/16	1 across	5,000	\$3.00
3 x 15/16	4 across	20,000	\$2.00
3.3 x 15/16	4 across	20,000	\$2.05
31/2 x 15/16	1 across	5,000	\$1.90
31/2 x 15/16	2 across	10,000	\$1.90
31/2 x 15/16	3 across	15,000	\$1.90
31/2 x 15/16	4 across	20,000	\$1.90
4 x 15/16	1 across	5,000	\$3.21
4 x 15/16	3 across	15,000	\$3.21
4 x 1-7/16	1 across	5,000	\$3.25
4 x 1-7/16	3 across	15,000	\$3.25
Prices	quoted for	full boxes	only.

Designed for the 31/2" disk.

"The Quality Disk & Label Specialist Since 1982" 1040 Broadway Westville, NJ 08093

609-456-6996 FAX# 609-456-7172

All products assembled in the U.S.A. All orders F.O.B. Westville, NJ C.O.D. orders add \$2.20

## merican

Semiconductor' Complete units as low as

XT, AT, & 386 Compatibles Not a Lease-You own it

- ★ 2,500 Service Centers!
- ★ Instant Credit!
- ★ Technical Support!

Call for Details 1-800-825-SAVE

Circle 19 on Reader Service Card

## Cross-32 Meta Assembler

Table based macro cross-assembler using the manufacturer's assembly mnemonics.

Includes manual and MS-DOS assembler disk with tables for all of the following processors:

64180 65C02 68HC11 6801 6805 6809 680X0 80X86 COP400 COP800 8096 TMS320 TMS370 Z8/Z80 ...MORE

Users can create tables for other processors!

Generates listing, symbol table and binary, Intel, or Motorola hexcode.

Free worldwide airmail shipping & handling.

Check, MO, VISA or MC: US\$199 or CN\$249

Universal Cross-Assemblers POB 384, Bedford, NS Canada B4A 2X3 (902) 864-1873

Circle 267 on Reader Service Card

#### A HIGH QUALITY RS232-RS422 BIDIRECTIONAL **CONVERTER AT A LOW PRICE**



Converts RS232 over 100 \$ 59.90 inks to long distance RS422 standards on cable lengths to 4.000 feet, while having high noise immunity for use in industrial environments. This module makes it possible for RS232 equipped devices, such as an IBM personal computer, to interface with an RS422 equipped device. Included in the many uses of this converter is the ability to communicate with Anaheim Automation's own step motor motion controls. The unit includes a power supply. Call or write for brochure.

ANAHEIM AUTOMATION 910 E. Orangefair Lane, Anaheim, CA 92801 (714) 992-6990 Telex: 2978217 MCI FAX: 714-992-0471

Circle 22 on Reader Service Card

#### 8051 SIMULATOR

for the IBM PC/XT/AT

The 8051SIM software package assists in the debug of 8051 family programs. A screen oriented, menu command driven program, 8051SIM simulates the Intel 8051 family of single chip microcomputers. This learning tool also speeds up the development process.

#### 8031 DryICE \$199

The 8051 Dry ICE is a hardware/software package that allows you to dump and modify memory; execute and trace 8051 family code in your target system. Hardware connects between target system and any serial port.



HiTech Equipment Corporation 9560 Black Mountain Road San Diego, CA 92126

(619) 566-1892

Circle 113 on Reader Service Card



## MULTIPROGRAMMERS™

Model 135-E: \$99500

- Model 135 is a SET Programmer, GANG Duplicator, & UNIVERSAL Device Programmer
- Programs virtually all 24, 28, & 32-pin (E)PROMs.
- RAM expandable to 2MegaByte.
  Optional support for 40-pin EPROMs, Bipolar PROMs, 40-pin Micros, & (E)PLD/GAL/FPLA's.
- DATA I/O\* protocal compatibility.
- 18-Month WARRANTY & 12-Month FREE Device Updates.

1-800-523-1565 In Florida: 1-407-994-3520

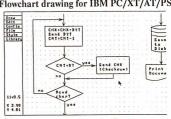
BYTEK Corporation 1021 S. Rogers Cir., Boca Raton, FL 33487 FAX: (407) 994-3615 Telex: 4998369 BYTEK \* (U.S. Prices only) \*DATA I/O is a registered Trademark of DATA I/O

Circle 44 on Reader Service Card

#### **TurboFlow**

\$69

Flowchart drawing for IBM PC/XT/AT/PS2



#### \$89 with Logitech mouse!

- Pop-up icon menus
- Variable size symbols
- Paper size to 34" x 44"
- Hercules mono, CGA, EGA
- HP-GL, DM/PL, SweetP Plotters Automatic PANning to scan drawing quickly

IBM/EPSON, NEC, OKIDATA, HP LaserJet Daytron Electronics Inc. 610 S. sherman #104, Richardson, Tx 75081

Add s&h (\$4 USA, \$20 foreign), Texas residents add 8% sales tax Order Today! 1-214-669-2137

Money-back guarantee

## **Priority One**

he ultimate in VGA performance. V-RAM VGA from Video 7 combines 100% VGA hardware compatibility with the superior performance of VRAM technology to give high-speed operation

V-RAM VGA is 100% hardware compatible with the IBM PS/2 Display Adapter. It even offers the highbandwidth monochrome mode and other VGA registeres not documented by IBM.

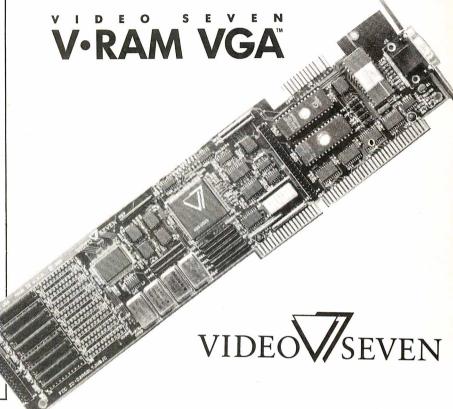
- 100% IBM PS/2 VGA compatible
- Works in PC/XT/ATs and PS/2 model 30
- 15 pin analog video connector
- 256K VRAM memory expandable to 512K

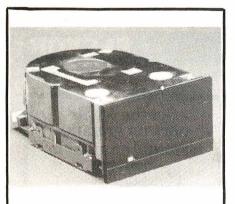
\$554.99 Retail \$799.00

#### VRAM

Video Random Access Memory (VRAM) was developed to meet the high-speed requirements of high resolution video applications. VRAM adds speed by eliminating the wait states caused by slower DRAM chips. Until now, VRAM technology was only available on specialized, high-priced graphics boards. But by developing anew chip-the V7VGA-Video Seven was able to bring high technology down to a sensible price.

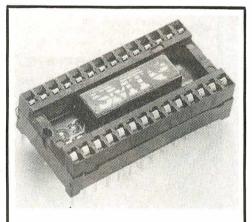
#### 5 YEAR WARRANTY!



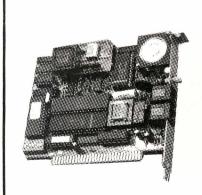


**QUANTUM** 42.7 Mbyte Hard Disk

\$279



No-Slot Clock



1200 bps Internal Modem Hayes Compatible

MORE SPECTACULAR SPECIALS

NEC MultiSync II \$599.99 \$69.99 Taxan 123 Green NEC MultiSync GS \$199.99 Taxan 124 Amber \$74.99 NEC MultiSync+ \$899.99 Orchid Tiny Turbo \$249.99 Video 7 VEGA VGA NEC MultiSync XL \$1954.99 \$249.99 Taxan 770 Plus \$499.99 Video 7 Fast Write \$399.99





21622 Plummer St., Chatsworth, CA 91311



(800) 423-5922 FAX (818) 709-4362



Same Day Shipping . Money Back Guarantee (call for details) No credit card surcharge - limited to stock on hand

PRODUCT AND PRICING MAY NOT BE AVAILABLE IN RETAIL STORES



#### Circle 8 on Reader Service Card



#### Circle 271 on Reader Service Card



Circle 98 on Reader Service Card

#### Okidata ML 82A and ML 83A Printers: IBM EMULATION "PLUS"



PC-WRITER ONLY \$99.00

plus shipping & sales tax (Calif. addresses) Money back guarantee

- FULL EMULATION OF THE IBM PC GRAPHICS PRINTER
- LETTER QUALITY PRINTING
- ELITE CHARACTER PITCH
- · SUBSCRIPTS/SUPERSCRIPTS
- **DOT ADDRESSABLE GRAPHICS**
- FRONT PANEL FEATURE SELECTION

To Order: (714) 261-0228 Dealer Information Available

RAINBOW TECHNOLOGIES, INC.

18011-A Mitchell So., Irvine, CA 92714 (714) 261-0228

Telex: 386078

Circle 227 on Reader Service Card

#### **PROGRAMMERS** FOR IBM PC/XT/AT



- Select Device with vender name & type number directly Enable user to set up Program Pulse Width. Vpp. Vcc. Over-program Pulse Width & Iteration Counts.
- Capable of set & 8/16/32-bits wide—word programming. XP6000A Adapter & cable installs in PC for

connecting programmer externally 1-socket 1M-bits EPROMs programmer XP6001 \$160 8-socket 1M-bits EPROMs programmer KP6002 \$375 1-socket MCS-48 micros programmer 1-socket MCS-51 micros programmer 4-sockets 1M-bits EPROM programmer \$270 KP6004 XP6014 \$260 AT-101/A EPROM Eraser erases 30 24-pin ICs \$195 with timer

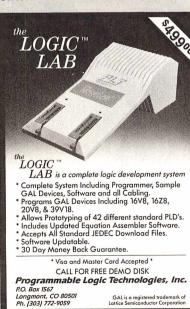
#### 2 YEARS GUARANTY + 30 DAYS MONEY BACK WARRANTY



Xender Corporation 2824, KENNEDY BLVD.,1FL., JERSEY CITY, NJ 07300 TEL: 201-659-8291 Tlx: 910 240 4444 CHAMPION

Fax: 201-864-9737

Circle 280 on Reader Service Card



Circle 206 on Reader Service Card



Digital Scopes to 200 MHZ

High Speed Bus Adapters Waveform Synthesizers Data Loggers

And Much More Call or write for a FREE handbook today! 203-786-51515 BEST products from the world's leading PC hardware and software vendors into risk free turn-key system solutions that meet your needs.

Toll Free Hotline for application assistance and convenient one stop shopping at competitive prices. 100% Satisfaction Guaranteed.

CylerResearche

Circle 71 on Reader Service Card

#### **DATA ACQUISITION TO GO** INTERFACE FOR ANY COMPUTER





Connects via RS-232. Fully IBM compatible. Built-in BASIC. Stand alone capability. Expandable. Battery Option. Basic system: 16 ch. 12 bit A/D, 2 ch. D/A, 32 bit Digital I/O. Expansion boards available. Direct Bus units for many computers.

(201) 299-1615

P.O. Box 246, Morris Plains, NJ 07950

Circle 90 on Reader Service Card

#### Get the whole story on graphics terminal emulation.



To find out more about software that lets your PC emulate TEKTRONIX™ 4105/6/7/9 and DEC VT100™ terminals, call or write:



GRAFPOINT

4340 Stevens Creeks Blvd., Suite 280, San Jose, CA 95129 (408) 249-7951

Circle 106 on Reader Service Card

## Daisywheel Printer...\$198

Satisfaction **Guaranteed! Since 1975** 

#### Turbo-XT \$398



- 4.77 & 10 MHz
- 640K Motherboard with 256K
- 8 slots
   8087 socket
- 150W power supply

#### Turbo-286 \$998



- 1 MB Motherboard with 640K
- 6 or 10 MHz switchable
- 8 slots 80287 socket
- 200 watt power supply
- 1.2 floppy disk drive
- Hard disk/floppy controller

#### Option A...Add \$148

- High resolution amber monitor
- Graphics card & printer port

#### Option B...Add \$258

- Hi-res RGB color monitor
- Graphics card & Printer port

#### Option C

Hard disk drive

30 MB for XT 40 MB for XT 40 MB For AT add \$298 add \$398 add \$348

#### Amdek 310A \$98

Best selling hi-resolution non-glare amber monitor



#### intها Math Coprocessors

8087 \$98	8087-2 \$138
8087-1 \$198	80287-6 \$178
80287-8 \$228	80287-10 \$288
80387-16 \$468	80387-20 \$728

#### Mouse

With Software LogiTech mouse ......\$78 Mouse systems mouse ......\$98 Microsoft mouse ..........\$108

Fastrap trackball .....\$98 Deluxe joystick .....\$24 Place orders toll free! Continental U.S.A. 1-800-421-5500

Inside California 1-800-262-1710 All others 1-213-973-7707

Fax machine 1-213-675-2522 Prices at our eight store locations will be higher on some items.

California

Torrance, Santa Ana, Woodland Hills Kearny Mesa. Sunnyvale

Texas Addison, Houston Georgia Smyrna



#### 1200 Baud Modem



1200	baud	external	. \$88
2400	baud	½ card internal	\$128
2400	baud	external	§168

#### 30 MB Hard Disk

Complete kit with controller



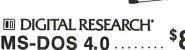
#### 360K Disk Drive Half height,

Direct Drive



Tandon TM100-2 full height.	\$89
1.2 MB for AT	. \$98
51/4" drive for PS/2	\$218
720K 3½" disk drive	
1.44 MB 3½" disk drive	128

#### No Slot Clock \$48



### VGA Package

Monitor & Card \$648

- 800 x 560
- Up to 256K brillant colors

Hi-res EGA card 640x480 \$128
EGA monitor 640x350\$378
VGA AutoSync 800 x 560 \$498
NEC MultiSync II 800x560 \$598
RGB color monitor 640x240 .\$258
Vega VGA card\$278
Paradise VGA card\$278

#### Daisywheel Printer

26 CPS

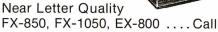
40 CPS



Diablo compatible, 1 year warranty Parallel Interface I interface

#### **EPSON 9 Pin**

\$198 LX-800



#### **EPSON 24 Pin**

\$369 LQ-500

Letter Quality Printers LQ-850, LQ-1050, LQ-2500 . . Call

#### HEWLETT PACKARD LaserJet II



Super 89 ii	า 1 Font	
Cartridge.		\$398
Extra Tone	er Cartridge	\$ \$98
PDP 4 MB	RAM card	w/OK \$198
1 MB \$348	2 MB \$648	4 MB \$1148

DeskJet

PDP 128K RAM \$98 \ Extra ink cartridge \$18

## **Laser Printer**

Toner cartridge .....

#### OKIDATA

Okidata 320.... Okidata 321.....\$498 Okidata 390.....\$498 Okidata 391......\$688

We accept checks, credit cards or purchase

orders from qualified firms and institutions. No surcharge on credit card orders. CA., TX. & GA. residents add sales tax. Prices & availability subject to change without notice. Shipping & handling charges via UPS ground 50¢/lb. UPS air \$1.00/lb. Minimum charge \$3.00.

Hawthorne California 90251-5046





4901 W. Rosecrans Ave Box 5046



#### Disk#ASTER The Ultimate Diskette Value DISKMASTER Discover the Difference ... 2 FOR 1 LIFETIME WARRANTY

- ✓ Pkg'd in 6 different colors, bulk or boxed COLOR
- ✓ 100% tested and certified
- ✓ Guaranteed clipping level of 65% or above
- ✓ Includes tyvek envelopes (not paper), write protect tabs and user labels

✓ Quality at affordable prices

5-1/4" - 48 TPI DS-DD

DS-HD 96 TPI **IBM-AT Compatible** 

BUIK COLOR OR GRAY

#### America's Premium Guality Color Diskettes

- ✓ TIMELESS WARRANTY
- √ 75%+ clipping level quaranteed
  √ Each disk 100% tested and certified
  ✓ The state of the s
- 18 COLORS for data organization
- ✓ Pkgs. include sleeves, w/p tabs, & ID labels

5-1/4" - 48 TPI DS-DD

DS-HD 96 TPI IBM-AT Compatible

PLASTIC STORAGE BOX COLOR

3-1/2" - 135 TPI

3-1/2" - 135 TPI DS-DD COLOR .75

PLASTIC STORAGE BOX

BLACK DS-HD 4.50

D BASE 48 TPI DS-DD .b4 3-1/2" DS-HD

DS-HD 96 TPI **IBM-AT Compatible** 

3-1/2" DS-DD

Call for best prices on Data Cartridges & Pelikan Ribbons

5-1/4" - 48 TPI DS-DD



DS-HD 96 TPI IBM-AT Compatible

5-1/4"- 48 TPI DS-DD



DS-HD 96 TPI **IBM-AT Compatible** 

Exceeds ANSI specifications +6¢ FOR TYVEK

#### ORDERING INFORMATION

TERMS: P.O. orders accepted, government and schools on net 30, SHIPPING: U.S. orders add \$3.00 per 100 diskettes or fraction thereof, add \$3.00 for COD orders

PRICE PROMISE: We will better any lower delivered price on the same products and quantities advertised nationally.











1376 W. 8040 S. / WEST JORDAN, UT 84088 HRS: 8 AM TO 5 PM (MTN. TIME)

the HUSKY

**EPROM** PLD MICRO GANG

SET



PC based PROGRAMMER \$599.00\*
\*modules not included.

From A Name You Can Trust

#### LOGICAL DEVICES, INC.

1201 N.W. 65th Place, Ft. Lauderdale, FL 33309

1-800-331-7766 (305) 974-0967 Telex 383142 Fax (305) 974-8531

Circle 142 on Reader Service Card (DEALERS: 143)

#### ON TARGET ASSOCIATES

Products and Services

for Design and Manufacturing Engineers.

Micro Channel Design Consulting Prototype Cards -Newsletter - ASIC's PS/2 Extender Cards Adapter Bracket Sets Burn-in Mother Boards

We will move your PC/XT/AT products to the Micro Channel, or create your new design.

> CALL: (408) 980-7118 for our Free catalog

...the PS/2 leaders.

PS/2 and Micro Channel are trademarks of IBM Corp.

Circle 187 on Reader Service Card





- · Mainframe to PC Data Transfer
- . High Speed Backup
- All Software, Complete System · Service and Support, easy Installation

call (818) 343-6505 or write to: Contech Computer Corp. P.O. Box 153 Tarzana, Calif. 91356

CONTECH

Circle 68 on Reader Service Card

#### **PALMERASE**<sup>IM</sup>

World's Smallest UV



PALMERASE™ can erase 20, 24, 28, and 40pin EPROMs in less than 3 minutes! Also, larger erasers are available to handle EPLDs, MICROs and other UV erasable devices. Please call today for more information on an eraser that's right for you.

#### LOGICAL DEVICES, INC.

1201 N.W. 65th Place, Ft. Lauderdale, FL 33309 1-800-331-7766 • in Florida: (305) 974-0967

Circle 144 on Reader Service Card (DEALERS: 145)

Easiest IEEE 488(GPIB/HPIB) Interfaces for your PC, PS/2, Macintosh, HP and more!

- Controllers
- Converters
- Extenders
- Buffers

Boards

Please see our ad on page 140.



25971 Cannon Road • Cleveland, Ohio 44146 Telex 6502820864 • Fax (216) 439-4093

Circle 123 on Reader Service Card



plugging in our hardware/software

>COMSCOPE>

No internal changes required, just plug into two serial ports on your IBM XT/AT or compatible and run our software (we have extra serial ports available). Provides data code conversion & capturing, saying to disk files. For passive data collection or generating messages and capturing reply. At this price there is no excuse not to have one! C/ w 120V adaptor.......\$399

AUTOMATION INC

P.O. Box 8019 Blaine, WA 98230 FAX: 604-946-0343 Phone: 604-946-4523 or 604-270-9614

Circle 287 on Reader Service Card

## **California Digital**

17700 Figueroa Street • Carson, California 90248





Color Monitor

Ideal for CAD/CAM and Desk Top publishing applications. The Roland CD/240 color monitor has a resolution of 720 pixels by 400 lines on a 31mm dot pitch 12" non-glare screen. VGA specifications in text mode EGA in

dot pitch 12 information Surprise Surpr

20" Analog Color

dents around a 12 inch monitor? This 20 nch analog RGB monitor is the idea solution. High screen resolution of 1200 pixels by 950 lines allow extra fine detail without the dots looking like golf balls. 256 colors and VGA compatible. Super value originally sold for over \$2000. Only 350 available.



Head Crash, Power Spikes or just poor disk maintenance...

Don't loose data because you didn't back up. The All/40 is an inexpensive way to save and restore files in the event that your data has been distroyed.

This 40 megabyte half height tape back is manufactured by North Americas largest producer of data retrieval equipment.

No need to purchase a separate tape controller... the ALL/40 attaches directly to your existing floppy olisk controller. Supplied software allows your computer to back up any time Day or Night. Come back in the morning and 40 megabytes of irreplacable data has been stored on one Scotch DC/2000 data cassette. Back up entire hard disk, modified files only, or by file name. Loss of data is inevitable but when you are backed up on an ALL/40 its not a catastrophe.



	One	Two	Ten
TEC501 1/2 height sgl.side	49	39	35
TANDON 65L/2 360K, 1/2 ht.	79	75	72
TANDON 101/4 full ht. 96 TPI.	99	89	79
FUJITSU 51/4" half height	95	89	82
MITSUBISHI new 501 half ht.	119	109	105
MITSUBISHI 504A AT comp.	149	139	135
TEAC FD55BV half height	109	99	89
TEAC FD55FV 96 TPI, half ht.	119	109	105
TEAC FD55GF for IBM AT	149	139	135
PANASONIC 455 Half Height	109	99	89
<b>PANASONIC 475 1.2 Meg./96</b>	119	115	109
Switching power supply			49
Dual enclosure for 51/4" drives			59

#### 31/2" DISK DRIVES

SONY MP-53W 720K/Byte	129	125	119
SONY MP-73W, 2 Meg.	159	149	call
TEAC 35FN 720 K/Byte	129	119	115
TEAC 35HN/30, 2 Meg.	159	149	145
51/4" form factor kit			20

89	179	175
19	109	99
19	309	299
89	179	165
89	179	165
	89	89 179 89 179



VISA

8:00 AM to 5:00 PM Pacific Time



an IBM/AT compatible. Complete with 512 K/byte of memory, (expandable to 1 Meg.) 101 key keyboard, your choice of either 1.2 meg. 51/4" or 31/2" floppy drive, clock/calendar and hard disk controller that supports upto 140 Megabytes of Winchester storage.

Eight card slots along with a 200 watt power supply

gives you plenty of expansion capacity.
This 100% IBM/AT compatible will run all programs writter for AT's and PC's. The Eclipse 286/12 is a super value at only \$895.

Options available: Hard disk drives Addtional Floppy Drives Monitors ● Video Cards ● Modems ● Memory



The Hitachi 672/XD is a four color 11 by 17 (B size) plotter with superior accuracy and repeatability (.3mm). The 672 accepts HPGL 7475 commands and is both Centronics parallel and RS232C compatible.

HS232C companies.
The 672 plots at a fast eight inches per second in axial direction and eleven inches at an angle of 45 degrees. The plotter also features a self contained digitizing function that allows data to be entered into your computer from printed graphs and blue prints. Four different color pens are supplied with the plotter but a wide variety of technical pens are available.

# 2400 Baud Modem

the Worlds largest producers of 295. While supplies last California

Smarteam 2400

Consumer electronics. Orginally priced at \$25 Digital is offering the MAX/2400 at only \$119.



The Smarteam 2400 offers all the features of the Haves Smart Modem 2400 for a fraction of the price. Now is your opportunity to purchase a 2400 baud

MODEMS	
Avatex 1200E external, Hayes compatible	\$89
CTS 1200 baud modem	89
Hayes Smartmodem 2400 baud modem	529
Smarteam 2400 Hayes Compatible	259
Smarteam 1200 Hayes Compatible, 300/1200	119
Smarteam 1200B IBM 1200 baud card	119
UltraLink 1200 data and voice, Bell 202	59
U.S. Robotics 2400 baud Direct, internal	139
U.S. Robotics 9600 bps. Courier HST	759
Signalman Mark VI, 300 baud internal PC	36

#### 21 Megabyte Gold Card



The Gold Card from Silicon Valley Computers features shock mounted automatic head unloading, 15 watt drive coupled with a 2K/byte sector buffer and advanced OMT controller for maximum reliability. 30,000 hour MTBF and full 2 year warranty — the best cost per megabyte hardcard available. Also available the 30 Meg. Gold Card at only \$419.

# *NEC/8500*

The NEC PC/8500 laptop computer incorporates a 25 The NEC PC/8500 laptop computer incorporates a 25 line liquid crystal display and modem that plugs directly inci any RJ/11 wall jack. An auto log/on feature instructs the 8500 to phone the users nost computer and automatically send password and log/on information. The computer also includes both serial and Centronics parallel ports packaged in this six pound laptop. This is the ideal computer for Realtors, insurance people or any individual that requires immediate access to remote information. ROM based telecommunication software, spreadsheet and Wordstar also make the 8500 a great computer for students. Files can be transferred from this CP/M computer to any other including the IBM/PC.



Hard to believe ... but we found a stash of brand new Zenith/Heath Model H/89 computers. These computers feature the Zilog Z-80 CPU and operate under CP/M. The unit incorporates a 12 inch green screen, three serial ports and one 5½" disk drive. Zenith's original price was \$1895. We have \$50 units available for sale, while supplies last we are offering the H/89 at only \$179.

## 40 Megabyte Hard Disk Kit

Forty megabyte internal hard disk drive, controller and cables

all for only \$397. The kit includes the a 40 millisecond Miniscribe 3650 drive and a half slot Western Digital controller.





**Five Inch Winchester Disk Drives** 

Price does not include controller. SEAGATE 225 20 Meg. ½ Ht. 239 SEAGATE 238 30 Meg. RLL 259 SEAGATE 251/151 M. 28mS. 459 SEAGATE 4096 96 M. 35mS. 659 SEAGATE 4096 96 M. 35mS. 559
MINISCRIBE 8425 25 M 65ms 239
MINISCRIBE 3650 50M 61 ms. 419
MINISCRIBE 6085 90 meg. 795
MINISCRIBE 3053 25 ms. ½ ht. 459
FUJITSU 2242 55 M. 35mS. 1299 227 399 779 FUJITSU 2243 86 M. 35mS. 1695 RODIME RO-204E 53 Meg. 895 1619 859 MAXTOR XT1140 140 Meg. 1595 1550 MAXTOR XT2190 192 Meg. 1919 1875 TOSHIBA MK56 70 M. 30mS. 1289 1229 CONTROL DATA WREN "V"

Every year since 1973, customers from virtually every nation in the free World have chosen California Digital for their data processing requirements. If its computer, California Digital has it... complete minisystem or just one

microchip. California Digital offers over 10,000 unique computer products.

Regardless of how specialized your data processing requirements... California Digital is your one stop shopping solution.

 Winchester Controllers for IBM/PC XEBEC 1220 with floppy controller DTC 5150CX 119 5527 RLL controller

ADAPTEC 2070 RLL controller ADAPTEC 2372A 1/1 interleaf WESTERN DIGITAL WD/1002WX2 99 WESTERN DIGITAL 1003WAH or WA2 139 WESTERN DIGITAL 1007/WA2 ESDI 239

● SCSI/SASI Winchester Controllers ● XEBEC 1410A 51/4" foot print WESTERN DIGITAL 1002-05E 51/4" OMTI 20L

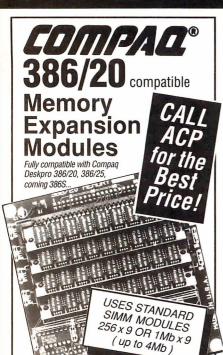
 Winchester Accessories Dual floppy enc. and powersupply

Winchester enclosure and supply Switching power supply

TECHNICAL & CALIFORNIA (213) 217-0500 TOLL FREE ORDER LINE (800) 421-5041

Telefax @ (213) 217-1951

## IC's, Parts, Components...Shipped Fast! West Coast's Largest Selection... Call for More



## DYNAMIC RAM

	SIMM 1 Mb x 9/IBM, 100ns \$550.00 SIMM 1 Mb x 8/APPL, 120ns 450.00 SIMM 256k x 9/IBM, 120ns 130.00 SIMM 256k x 8/APPL, 120ns 110.00 1MBIT 1Mb x 1, 100ns 38.00 1MBIT 1Mb x 1, 120ns 35.00 *51258 256k x 1, 80ns 13.95	41464 64k x 4, 100ns 41464 64k x 4, 120ns 41464 64k x 4, 150ns 4164 64k x 1, 100ns 4164 64k x 1, 120ns 4164 64k x 1, 150ns 4164 64k x 1, 150ns	call. call. 3.75 3.35 2.95 8.95
	*51258 256k x 1, 100ns 11.95	4410 10K X 4, 12015	3.95
	41256 256k x		8.95
	41251		
	41000		ارتونا
	4125		<b>-</b> /5
	41250		SS.00
	41250	1 Mb x 1 ZIP, 100ns	39.00
	41256 200K OU J. 95	1 Mb x 1 SOJ, 100ns	42.00
	41256 256k x 1, 80ns <b>12.95</b>	1 Mb x 1 PLCC, 100ns	42.00
	41256 256k x 1, 100ns 12.50	256k x 1 ZIP, 120ns	12.95
	41256 256k x 1, 120ns 10.95	256k x 1 PLCC , 120ns	13.95
1	41256 256k x 1, 150ns <b>10.50</b>	256k x 1 SOJ, 120ns	13.95
43.00	+41264 64k x 4, 120ns <b>19.95</b>	+Dual Port RAM, Video RAM	
-		*51258's-static column RAM for Compaq 386 or	
	+41264 64k x 4, 150ns <b>16.95</b>	For High Speed, ZIP, PLCC, MoreCa	11!!

PROCESSORS
80387-20 \$ <b>729.</b>
80387-16 <b>469.</b>
80287-10 <b>285.</b>
80287-8 <b>235.</b>
80287-6 <b>159.</b>
8087-1 (8 MHz) 189.
8087-2 (10 MHz) <b>145.</b>
8087 (5 MHz) 99.
80386-16/20 call.
80386-16 <b>499.</b>
80386-20 <b>799.</b>
V-30 8 MHz 12.95
V-20 10 MHz 12.95
V-20 8 MHz 10.95
CONON SERVES

8088-1	6.50
STATIC RAMS	
62256-32kx8,120ns \$	14.95
6264-8kx8,150ns	9.95
62C64,150ns	10.95
6116, 2kx8,150ns	7.95
E PROMS	
27C101 128kx8,200ns	23.95
27C101 128kx8,250ns	
27C512 64kx8,150ns	
27C512 64kx8, 200ns	14.95

0000 1 0.00	21 0200 02KX0, 200113	0.50
STATIC RAMS	27256 150ns	8.95
62256-32kx8,120ns \$ 14.95	27256 200ns	5.95
	27256 250ns	5.50
6264-8kx8,150ns <b>9.95</b>	27C128 250ns	5.95
62C64,150ns <b>10.95</b>	27128A 16kx8, 150ns	8.95
6116, 2kx8,150ns <b>7.95</b>	27128A 16kx8, 200ns	5.75
E PROMS	27128A 16kx8, 250ns	4.95
27C101 128kx8,200ns 23.95	27C64 8kx8, 150ns	5.95
27C101 128kx8,250ns <b>22.95</b>	27C64 8kx8, 200ns	4.95
27C512 64kx8,150ns <b>15.95</b>	2764 150ns	5.95
27C512 64kx8, 200ns <b>14.95</b>	2764 200ns	4.95
27512 200ns <b>13.95</b>	2764 250ns	3.95
27512 250ns <b>12.95</b>	2732A 250ns	4.95
27C256 32kx8, 150ns <b>8.95</b>	2732A 21V 200ns	5.95
7/100 SEB	-0	

27C256 32kx8, 200ns	5.95
27256 150ns	8.95
27256 200ns	5.95
27256 250ns	5.50
27C128 250ns	5.95
27128A 16kx8, 150ns	8.95
27128A 16kx8, 200ns	5.75
27128A 16kx8, 250ns	4.95
27C64 8kx8, 150ns	5.95
27C64 8kx8, 200ns	4.95
2764 150ns	5.95
2764 200ns	4.95
2764 250ns	3.95
2732A 250ns	4.95
2732A 21V 200ns	5.95
ES	I

8000's 7220 \$ 8.95 80C31 5.95 80C35 3.95 8035 2.39	8088 5.95 81055 4.95 8155-2 3.95 8155 2.95 8203 14.95 8214 3.95	8255A-2 3.95 8255A-5 2.95 8259A 2.95 8259C-5 2.95 8279-5 3.95 8283 3.95
8039 2.49 8049 1.95 80C85A 3.95 8085A 2.95 8086-2 5.95 8086 4.95 8088-1 6.50	8226 2.95 8237A-5 4.50 82C51A 3.95 8251A 2.95 82C53-5 3.95 8253-5 2.95 82C55A-5 3.95	8284A 2.95 8286 3.95 8287 3.95 8288 4.95 8748 7.95 8749 9.95 8755 14.95

0.95 0.95 0.95
95
.29 .29
.29
.79

74F00 \$	.35	74F153 \$.59	74F243 \$1.29
74F02	.35	74F157 59	74F244 1.29
74F04	.35	74F158 59	74F245 1.29
74F08	.35	74F16059	
74F10		74F161 59	
74F11	.35	74F163 59	
74F20	.35	74F174 69	74F373 1.49
74F32	.35	74F175 69	
74F64	.49	74F181 1.99	
74F74	.49	74F189 2.99	
74F86	.49	74F219 4.99	74F521 2.99
74F109	.49	74F240 1.29	
74F139	.49	74F241 1.29	74F534 2.99
74F151	.59		
- ALLO		FRIES	

74HC SI	RIES			
74HC00 . \$.25	74HC125	\$.50	74HC174	\$.65
74HC0225	74HC132	.50	74HC175	.65
74HC0425	74HC133	.50	74HC240	1.29
74HC0825	74HC138	.55	74HC244	1.29
74HC0925	74HC139	.55	74HC245	1.29
74HC1025	74HC148	.75	74HC368	.65
74HC1125	74HC151	.65	74HC373	1.29
74HC1425	74HC153	.65	74HC374	1.29
74HC2025	74HC154	3.75	74HC4020	.99
74HC3225	74HC157	.65	74HC4060	.99
74HC7435	74HC161	.65	74HC4066	.99
74HC8565	74HC166	1.15	74HC4075	.89
74HC11265	74HC173	.65	74HC4078	1.49

7400	SE	RIES			
7400	\$.18	7474	\$.35	74157	\$.65
7402	.18	7475	.35	74158	.65
7404	.18	7476	.35	74173	.65
7405	.18	7485	.35	74174	.65
7406	.35	7486	.35	74175	.65
7407	.35	7490	.35	74176	.65
7408	.25	7493	.35	74181	1.75
7410	.25	7495	.35	74189	2.95
7414	.35	74121	.35	74193	.65
7420	.25	74123	.45	74195	.65
7426	.25	74125	.45	74198	1.65
7427	.25	74126	.45	74221	.75
7430	.25	74148	.65	74273	1.75
7432	.25	74150	1.20	74365	.50
7438	.25	74151	.65	74366	.50
7442	.30	74153	.65	74367	.50
7446	.85	74154	1.20	74368	.50
7447	.95				
700	17.				

1441	
<b>Z80 SERIES</b>	STEEL STATE
Z80CPU \$1.49	280ASIO/0 \$4.95
Z80CTC 1.49	Z80ASIO/1 4.95
Z80DART 4.49	9 Z80ASIO/2 4.95
Z80PIO 1.49	
Z80ACPU 1.99	
Z80ACTC 1.99	
Z80APIO 1.99	9 Z80BPIO 3.99
BIPOLAR PR	OMS/PALS
82\$123\$ 1.29	74\$189 \$1.69
82S126 1.29	
82S129 1.99	
82S137 2.99	
82S181 7.99	
82S191 11.99	
74S188 1.29	PAL 20L8 9.95

<b>ე</b> .	95					
	LINE	AR		30		
		\$1.19	LM566	\$1.10	LM3900	-
	CA3089	1.19	LM567	.75	LM3909	- 1
	CA3403	1.19	LM723	.30	LM3911	1
	LF347N	1.49	LM733	.30	LM3914	2
	LF348N	1.49	LM741	.30	LM3915	1. 2. 2. 2.
	LF356H	1.99	LM747	.60	LM3916	2.
	LF441	1.69	LM748	.65	LM4024	3.
	LM301	.30	LM1414	1.49	LM4044	3.
	LM309K	1.00	LM1886	3.29	LM4136	1.
	LM317K	2 95	LM1330	1.95	LM4558	
	LM317T	1.75	LM 1350	1.25	LM7555	2
	LM318	1.15	LM1358	1.95	LM7556	2
	LM319	.95	LM1372	2.25	LM7660	2
	LM320T-XX		LM1408L8	2.50	LM7663	2
	LM320K-XX	1.35	LM1458	.40	LM78H05	2. 2. 2. 6. 6.
	LM323K	4.25	LM 1488	.60	LM78H12	6.9
	LM324	.35	LM1489	.60	LM8038	3.
	LM335D2	1.19	LM 1889	2.50	MC3423	1.4
	LM336D2	1.19	LM2003	.75	MC3459	2.1
	LM337H	2.49	LM2206	3.75	MC3470	2.
	LM337K	4.95	LM2111	1.19	MC3480	6.
	LM338K	6.95	LM2211	2.75	MC3486	1.0
	LM340T-XX		LM2240	1.75	MC3487	1.6
	LM340K-XX		LM2900	1.19	LM3524	1.9
	LM358	.45	LM2901	1.19	TDA1170	5.4
	LM376	1.69	LM2917	1.29	TDA1180	5.9
	LM380	.95	LM3045	1.19	TL074	1.6
	LM386	.95	LM3054	1.99	TL081	
	LM393	.65	LM3079	1.49	TL082	1.3 1.3 1.3 1.3
	LM497	2.50	LM3130	.95	TL084	1.2
	LM565	.30	LM3140	.95	ULN2003	1.
	LM556	.45	LM3160	1.95	ULN2064	1.7
	LM558	.85	LM3161	1.95	ULN2074	1.9
	LM564 LM565	2.75	LM3162 LM3852	1.95	ULN2081	1.4
	LINI303	1.50	LIVI3052	1.49	ULN2981	1.9
	- ""	-	-			

024	3.95	call					
044	3.95						
136	1.50	ACF	4			MPUT	
558	.75					G COUNG	
555	2.50				OCE THIS RE	ary resociood	
556	2.50	74LS	SE	RIES			
660	2.95		1000		Section 2		
663	2.95	74LS00	\$.19	74LS125	\$.45	74LS241	\$.99
BH05	6.95	74LS02	.19	74LS126	.49	74LS242	.99
BH12	6.95	74LS03	.19	74LS138	.45	74LS243	.99
038	3.75	74LS04	.19	74LS139	.45	74LS244	.99
423	1.49	74LS05	.19	74LS153	.59	74LS245	.99
459	2.69	74LS08	.19	74LS154	1.29	74LS257	.69
470	2.99	74LS09	.19	74LS157	.40	74LS258	.69
480	6.99	74LS10	.19	74LS158	.40	74LS259	.99
486	1.69	74LS14	.35	74LS161	.49	74LS273	.99
487	1.69	74LS27	.28	74LS163	.49	74LS322	1.79
524	1.99	74LS30	.25	74LS164	.49	74LS323	1.79
170	5.49	74LS32	.28	74LS165	.49	74LS365	.59
180	5.99	74LS47	.99	74LS166	.99	74LS366	.59
4	1.65	74LS73	.35	74LS173	.49	74LS367	.59
1	.75	74LS74	.35	74LS174	.49	74LS368	.99
2	.85	74LS75	.35	74LS175	.49	74LS373	.99
4	1.25	74LS76	.35	74LS189	3.95	74LS374	.99
2003	1.19	74LS85	.49	74LS190	.49	74LS393	.99
2064	1.79	74LS86	.28	74LS191	.49	74LS624	1.89
2074	1.99	74LS90	.45	74LS192	.49	74LS629	1.89
2081	1.49	74LS93	.45	74LS193	.49	74LS640	1.89
2981	1.99	74LS107	.45	74LS195	.49	74LS641	1.89
_ " "		74LS109	.45	74LS221	.65	74LS670	.99
9!!	!	74LS123	.49	74LS240	.99	74LS688	1.89
-7-	1000						TOTAL PROPERTY.

...just

the Nation's TOP

#### Advanced Computer Products, Inc.

Mail Order: P.O. Box 17329 Irvine, CA 92713 Retail: 1310-B E. Edinger, Santa Ana, CA 92705

for Fast Service Order by Phone!

**NEW PHONE FOR ALL USA** 800-FONE ACP 800-366-3227 • 714-558-8813

Call ACP Toll-Free

\$25.00 Minimum MAIL ORDER
No Surcharge for VISA or Mastercard
Volume purchasing agreements available

• Orders subject to change without notice

• Supply limited ACP Retail store pricing may vary. Not responsible for typos. Limited warranties and other conditions may apply

Call for our NEW 1988 Catalog...

Since 1976...The Nation's TOP Computer Supplier

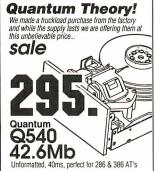


same resident fonts as the Laserwrites 

SPECIAL!! AST® Internal 1200 Baud Modem

software included.





ACP...famous since 1976 for delivering the Best Deals!!

	Special Purchase	EPSON SM
I COMIT	CLOSEO While Stock Lasts Bulk DS/DD 5-1/Diskettes box of 100	32¢
	Quadram Silver Box	sprint Card 10 MHz
	Liberty Card, EM     1200 Baud Interr with software	ns, ok
	Sharp PC5000 P     OmniPakl 1200 B     serial/parallel/clock	ortable sale 149. Baud Modem /game/RAM sale 99.
	<ul> <li>Diablo 620 Printe</li> </ul>	ersale <b>199.</b> al Computer //joy/MS-DOS 2.0 . <b>219.</b>
_	8514 16" Hi-res(1024x768)	1395. System Saver IIg



Don't feel like the Lone Ranger... we are also suffering from loss of memory. ACP sells more Memory Upgrade IC's than other other mail order supplier. But!...the present shortage is driving us up a wall!. We can't get them at the right price, but we are getting them. PLEASE BEAR WITH US...as the market price comes down, so will our price! Selling Chips? Call us, we're buying.



PC COMPATIBLE DRIVES	Ma Ma Ga
ACP Advanced Cards/IBM Monographics/HGA w/print port 55.	K
Colorgraphics w/printer port 55. SuperEGA,Genoa compatible 169.	KE
SuperVGA,1024x768	KF
	IB M
XT 286 Accelerator card	LI Fe
XT dual Floppy controller 29.	L
XT Serial I/O card	Bi Se
AT Serial I/O card	Se
XT/AT Parallel I/O card 29. AT Serial I/O card 39. XT/AT Game adapter port 29. XT/AT EPROM programmer 149. AT 3.5Mb w/Multi I/O, 0K 199. AT SuperMULTI I/Ow/floppy 119. PS/2 Multi I/O 99. PS/2 Floppy controller 1.4Mb 89.	Bu
AT SuperMULTI I/Ow/floppy 119.	Se
PS/2 Floppy controller 1.4Mb	M PC
	PS
MOTHERBOARDS           XT Turbo w/BIOS, 8MHz         89.           XT Turbo w/BIOS, 10MHz         99.	PO
XT Turbo w/BIOS, 10MHz 99. AT 286 w/BIOS, 10 MHz 289.	St
AT 10700 WBIOS, 10MHz 99. AT 286 w/BIOS, 10 MHz 289. AT Baby w/BIOS, 12MHz 299. AT 386 w/BIOS, 16MHz 1499.	8
HARDWARE	<i>S</i>
AST Research	71 55
Xformer/286, 512K, 10MHz 699. Advantage 2/386, mod. 80, 1Mb 725.	T
Advantage 2/286,PS/2,0K 349. Advantage Premium 286,512K 389.	FE 31
Advantage 2/286,PS/2,0K 349. Advantage Premium 286,512K 389. Rampage 2/286,PS/2,512K 499. Rampage 286,512K 489.	N
Rampage 286, 512K	NI NI
ATI Technologies	
EGA Wonder 800	M
2400etc int. Modem w/MNP-5 188. GENOA	13
Super EGA	M 36
Super VGA	60
EZ-FAX Board w/software 1188. HERCULES	84
Color Card/ CGA	PI
INTEL	PI Si
Inboard 386/PC to 386 975. Inboard 386/AT to 386 1059.	ST
Above Board 2,PS/2 mod50/60 299. Above Board 286 AT 512K 329	ST
Above Board PS/286.model 30 349.	ST
8087 (5MHz) 102. 8087-1 (10MHz) PS/2 205.	ST
80287-6 (6MHz) 185	и Fil
80287-8 (8MHz)	Fil
80387-16 (16MHz)	10
80287-0 (IMMIZ) 255. 80287-10 (10MHz) 309. 80387-16 (16MHz) 549. 80387-20 (20MHz) 799. 0RCHID Technology Tiny Turbo 286 -REDUCEDI 289.	10
Tiny Turbo 286 - REDUCEDI 289. Designer VGA Board 299. RAMQUEST 50/PS/2, 2Mb 699.	10
RAMQUEST 50/PS/2, 2Mb 699.  PARADISE	
Autoswitch 480 199.	A V
VGA Plus	IC
Quad386XT	Be Be
MicrofozorII huffer w/64K 239	Be
Ouadsprint XT accellerator 98. Liberty EMS XT card, 0K 98. Silver Quadboard, Sixpak comp. 98.	Tr P(
VIDEO 7	PS
VEGA Deluxe	1F
	12

	uenven	ny me best bears::
Mach III Joystick-IBN Mach III Joystick-App	И 49. ple 49.	COMPUTERS
Gamecard III		Advanced 386 Clones w/0K
KEYTRONICS		Advanced386/16hace evetem 1705
KB101 101key/AT KB5151 84key deluxe		Advanced386/16 w/40Mb 2195. Advanced386/16w/80Mb 2495.
KRAFT		Advanced 286 Clones w/0K
IBM PC/XT/AT Joys Mouse PC/XT/AT se	rial 89.	Advanced286/10base system 849.
LIGHTGATE		Advanced 286 Clones w/0K         Advanced286/10base system       849.         Advanced286/10 w/20Mb       1099.         Advanced286/10 w/40Mb       1299.
Felix for PC/XT/AT . LOGITECH		Advanced XT Clones w/0K
Bus Mouse PC/XT// Serial Mouse PC/XT	AT 99.	AdvancedXT base system 489. AdvancedM/XTw/mono/20Mb 999.
Serial Mouse PC/XT Serial Mouse PS/2	7AT 99.	call for options & details
MICROSOFT		AST Research Premium286Model140,40Mb 2995.
Bus Mouse w/PC Pai	intbrush 105.	Premium Workstation 2195.
Bus Mouse w/PC Pai Serial Mouse w/PC P Serial PS/2 w/PC Pai	intbrush 118.	call for all AST modele
MSC Technolog PC Mouse serial PC	ies /XT/AT 98.	COMPAQ Portable III Model 20
PS/2 Mouse serial		Portable III Model 20 call. Deskpro286 Model 20 call.
PS/2 Mouse serial PC Mouse bus PC/2 SUMMAGRAPH.	(T/AT 98.	
SummaSketch	449.	Portable386 Model 40 call. EPSON
FLOPPY DISK		Equity I+call.
SONY	5,,,,,,	Equity II+ call. Equity III+ call.
31/2 Micro Floppy 1.4	44Mb 149.	HYUNDAI
TEAC 55BV 360K Floory	PC/XT/AT 89.	Hyundai286 call. HyundaiXT call.
TOSHIBA AMER	ICA	Hyundai PC LAN Terminal call.
FDD4403 31/2" Micro 31/2" Micro 1.44Mb	n 760K 129	NEC Multispeed EL backlit LCD call.
ND04D 360K Floppy ND04E-G 360K Flop	PC/XT 84.	Multispeed HD, 20Mb call.
ND04E-G 360K Flop ND08DE-G 1.2Mb A	py AT gray <b>84.</b> T gray <b>110.</b>	SHARP 4501 Laptop single floppy 699.
HARD DISK DE		4502 dual floppy, 640K
	IIVES	4520 Laptop, 20Mb 2195. PC7100 Portable, 20Mb 2195.
MICROPOLIS 1333A 53Mb Full ht.	, 30ms 649.	PC7221 Portable286, 20Mb 2895.
1335 85Mb Full ht.,6	5ms 849.	TOSHIBA
MINISCRIBE 3650 43Mb Half ht	61ms 389.	TOSHIBA T1000 Laptop, single floppy 779. T1200F Laptop, dual floppy 1395.
6053 53Mb Full ht.,2 6085 85Mb Full ht.,2 8438 38Mb Half ht.,	8ms 649.	T1200F Laptop, dual floppy 1395. T3100 Laptop 286, 20Mb 2995. T3200 286 full keybd, 40Mb 3995.
8438 38Mb Half ht.,	65ms.RLL 299.	T5100 386, EGA, 40Mb 4995.
PLUS Developm Plus20 Hardcard, 20 Plus40 Hardcard, 40	nent	NETWORKS
Plus40 Hardcard, 40	Mb,39ms 719.	зсом
SEAGATE		Ethernet card 399. Ethernet II card 399.
ST225 25Mb,65ms. ST138 38Mb New! 3	11/2" call.	WESTERN DIGITAL
ST238 38Mb,65ms. ST251 51Mb,40ms. ST251-1 51Mb,28m ST4038 38Mb,40m: ST4096 96Mb,28m	w/WD RLL 398.	StarLan/Novell starter kit 1077. (network for less than \$400/node)
ST251-1 51Mb,28m	s499.	Ethernet Plus adapter board 239.
ST4038 38Mb,40ms	S-REDUCEDI. 469.	ViaNet LAN software
WESTERN DIGIT FilecardPS30 PS/2m	TAL	MODEMS
FilecardPS30 PS/2rr Filecard30	nod.25/30 <b>389.</b> 	Advanced MODEMS
1006RAH Contr. 1:1	interleave 199.	1200baud w/software(int) 79.
1003RAH Controller 1003WA2 Floppy/Ha	RLL/AT 187. ard/AT 149.	1200baud External
1002-27X Controller	RLL/XT 98.	2400baud w/software(int) 149.
1002-WX1 Controlle		2400baud External
BACKUP DEVI	CES	Smartmodem 1200B w/sw(int) 299.
ALPHAMICRO VCR Video tane back	kup card 349.	Smartmodem 1200 External 299. Smartmodem 2400B w/sw(int) 447.
IOMEGA		Smartmodem 2400 External 447.
Bernoulli 20Mb 51/4* Bernoulli dual20Mb 5	internal 945. 51/4'ext 1699.	MIGENT Pocket MODEM 1200 129.
		PROMETHEUS
Tri-pak 20Mb cartrid	ige,51/4' 189.	2400G External
Tri-pak 20Mb cartrid Tri-pak 20Mb cartrid PC3B Adapter card PS4 AdapterPS/2mi	PC/XT/AT . 189.	
		1200B/2 w/software(int) sale! 79.
110D XT/AT 10Mb b 120D XT 20Mb back 145C AT 40Mb back 245P PS/2 40Mb ba	ackup(int) 199.	MONITORS
145C AT 40Mb back	up(int) 369. up(int) 499.	AMDEK VIDEO 310A 12" amber TTL 99.
245P PS/2 40Mb ba	ckup 479.	410A 12* amber grn or white 153.
TALLGRASS Tee 1020i AT 20Mb back	up(int)338.	
1020i XT 20Mb back	up(int) 338.	IBM MONITORS
1040i XT 40Mb back	up(int) 338. up(int) 338. up(int) 599. up(int) 599.	IBM MONITORS 8503 12' MONIG640X480) 228. 8512 14' Color analog
Call for External Pri	icingi	8513 12" EGA(640x480) 595.

	Mindset Personal Co 360K/floppy/mouse/joy/l	MS-DC
1 .	8514 16" Hi-res(1024x768)	
	MAGNAVOX Multiscan 14' multimode	399.
	CGA 13* color	288.
	NEC Multisync II 13" TTI /analog	505
	Multisync Plus 15' VGA/EGA	945.
	Multisync II 13" TTL/analog	1555.
	Flatscreen 12' amber TTL  Mono 12' amber TTL  CGA 14' RGB Color  EGA 14' EGA/CGA Color	. 88.
	EGA 14" EGA/CGA Color	395.
	CPD1302 13" Multiscan color CPD1303 13" EGA	699. 569.
	WVCE	
	WY30 14* terminal	349. 419.
		519.
	PRINTERS	
	DICONICS/KODAK  150P Portable printer(par)	339.
	FPSON	
	LX800 80column, 180cps	209.
	LQ1050,LQ1000ACP is your full line Epson of	call.
	HEWLETT PACKARD	
	Laserjet Series II	1799. 895.
	Scanjet flatbed scanner	1549.
	IBM PRINTERS Proprinter II, 240cps	435.
	Proprinter XL24, 240cps 24pin	635. 835.
	NEC           P2200, 24pin(360x360dpi)	399.
	P660 Pinwriter, 65cpsNLQ	599.
	OKIDATA	
	ML393,180cpsNLQ	995.
	ML192+, parallel ML193+, parallel Laserline 6 (req.IBM int.)	319.
	Laserline 6 (req.IBM int.)	1399.
	PANASONIC  KX-P1080i, 160cps draft,par  KX-P1091i, 192cps draft,par  KX-P1092i, 240cps draft,132  KX-P1524, 24pin, 80cpsNL0	185.
	KX-P1091i, 192cps draft,par KX-P1092i, 240cps draft,132	198. 339.
	KX-P1524, 24pin, 80cpsNLQ SEIKOSHA	595.
	SEIKOSHA SL80A1, 24pin SL130A1, 24pin	366.
	SL130A1, 24pin SBP10A1, 18pin, 800cps SK3000A1, 9pin, 300cps,s/p SK3005A1, 9pin, 300cps,132	3299.
	SK3005A1, 9pin, 300cps,132	499.
	P321SL, 24pin, 216cps	499.
	P341SL, 24pin, 216cps	699. 1099.
	SK3005A1, 9pin, 300cps, 132. <b>TOSHIBA</b> P321SL, 24pin, 216cps.  P341SL, 24pin, 216cps.  P351SX (color add \$179)  Pagelaser 12, High volume.	call.
	PLOTTERS	
	HOUSTON INSTRUMENTS	2399
	DMP41 or 42 DMP51 or 52 SCANCAD	3099.
	DMP56A	4399.
	ROLAND DXY880, 8 pen AB size DXY980	1088.
		1488.
	ACCESSORIES  COMPUTER ACCESSORI	ES
	P15 Power Director	. 89. . 62.
	F20 Print Saver	289

2.0	~	18	J.		Di	rect	repl	ac
Sys	tem S	Save	er Ilgs er, 80e	olur				19
MIC 51/4	CRC	OCC	omp. Disk Disk Disk Clean 2'x12 eyboa	A(	CCE File	ssc	RIE	S
31/2 PC	P Ro	lltop	Disk	ette i	File .			22
CR1	Vali erde:	et (1 sk K	2'x12 eyboa	?") . ird D	rawe	r	. 1	19
FNF	P n Min	FII IXT,	LE 100 5 7,100 8*, si 5 31/2	1/4",	,smo	ke		10
FNF	Mici	roX di,50	8", si	31/2 mok	2*,sm e	oke.		15
Univ	Mici versa	ro,2 I Pri	nter S	tano	moke i			. 5
5 1/	4° D	S/D	nter S ES-III D Dis -D	ketti	me I	Warr C/XT	anty 360K	11
Cuii	MADO	ח		00.				12
Adv	ance	a Cc	olor w	plas	tic bo	y AT	1.2M	8
Max	kell N batin	AD2 n Da	-DD .					23 23 22
Fuji 3 1/	2. H	DHS	Dens			(1.44	Mb)	
Max Veri	œll .		talife				010101	49
Fuji Son	y							49
PR Adv	ance	<b>ER</b> d 64	BUF K par K AB	FEI allel	95 buffe	r	1	29
SIA	IITC	'H	$P \cap V$	EC				
Adv	ance	d 2-	positi positi	on A	NB, 31	536 . 525 .		29
Adv	ance	d se	positi positi r/ser r/par C sha	conv	verte	 		69
Lug	ical (	JUIN	ECUIO	1 256	βK		. 4	99
Lon	glink	-Par	allel				1	99
Qui	cklin cklin	k-Pa	r to S r to F r to F	er-6	4K .		. 1	49
TR	IPP	LITI	E			er	2	99
Isot	oar4 s	surg surg	e sup	n w/	B out	ets .		59
Line	Con kup F	Pow	oner w er Sup	/4 o ply,	utlets 450v	v		149
Bac	kup f kup f	Pow	er Sup er sup er Sup er Sup	ply, ply,	675v	w		75
GC	kup i	ST	er Sup AR L	oply,	2000 1/SC	OPE	. 12 :S	999
DM	623	5-3	AR L 5 DV .5 DV .5 DV .5 DV .5 DV .5 DV	M .			52	9.9
DM	613	3-3	.5 DV .5 DV	M.			. 59	1.9
08-	704	0-40	MHz	Sco	ре		. 6	99
64K	or 2	56K	UP Upgr or Ra	ades	s(set	of 9)		al
\$	OF	TW.	ARE					
nc	p=n =co	ot o	proto cp	pro	otec ed	ted		
Pag	DU:	S-n ker/	CP IBM				4	199
Fre	ehan	d/M	MAC				ca	111
Adv	PHA	4 S	OFT	ks1.	<b>RE-1</b>	ср	. 1	232
A/A	ha/th	. Si	1.0 . <b>MAL</b> 3D 3	L B	USI	NES	S-n	
ΔA	ISA							
Par	adox	v1.	0 w/E	MS	&EEI	NS	: :	124
							٠. :	42:
Mu	ltima	ate A	dvan	tage	II 1.0	(		27 cal
DI	ומר	AM	0.00					13
Sid	ekick bo B	1.0	sale! C 1.0 CAL 4	old v	ers.			6
Tui	bo F	1.5	CAL 4	.0.				6
-	_	_	-	_	_	_	_	_

	Reflex 1.14	.99. 149. .99.
	Print Shop	40.
	Print Shop	23.
	Memory Mate 2.0-ncn	45.
	Memory Mate 2.0-ncp	
١.	Subscription kit	.29.
	Groilers Online Encyclopedia	34.
i.	COMPUTER ASSOCIATES-	пср
	COMPUTER ASSOCIATES- Supercalc 4 v1.1 Superproject plus v3.0	339.
	CROSSTALK COMME DOD	339.
	CROSSTALK COMM-ncp Crosstalk XVI v3.61 Crosstalk MK4 v1.01	99
	Crosstalk MK4 v1.01	139.
	DAC SOFTWARE-ncp	
	DAC SOFTWARE-ncp DAC Easy Light v1.0 DAC Easy Accounting v2.0	. 49.
	DAC Easy Accounting v2.0	69.
	GEM Draw plus v2.01	185.
	EVECUTIVE EVETERS	270.
	YTREE V2 0	45
١.	EXECUTIVE SYSTEMS-ncp XTREE v2.0 XTREE Professional v1.0	. 89.
	FUNK SOFTWARE-ncp	
١.	Sideways v3.2	.42.
	FUNK SOFTWARE-ncp Sideways v3.2 INWord v1.0	.59.
). ).	5th GENERATION-ncp	
	Fastback Plus FOX SOFTWARE	.99.
	Foxbase+ single user	220
).	GENERIC-ncn	220.
).	GENERIC-ncp Generic CADD 3.0	. 65.
). ).	LIFETREE-ncp	
i.	Volkswriter 3 Plus	160.
	LIFETREE-ncp Volkswriter 3 Plus Total Word v1.0	259.
	Hal	.99. call.
9.	Hal	349.
). ).	MECA-CD	
	Managing your Money, Tobias	129.
).	MICROLYTICS	
).	Goter	45.
). ).	Wordfinder	65.
j.	MICROPRO-ncp Wordstar Professional Rel 4	260
).	Wordstar 2000 Rel 3	199.
).	MICDODIM-non	
	R:BASE 5000	369.
5	R Base SystemV	469.
5	MICROSOFT-ncp Windows 386 . Windows 2.03 Quick C v1.0 . Quick BASIC .	400
5	Windows 300	139.
).	Quick C v1.0	69.
).	Quick BASIC	. 69.
ē	Word v4.0	.219.
1	Excel v2.0/A1	.319.
l. I.	NORTON-ncp	60
	Utilities 4.0	69.
		59.
	PAPERBACK SOFTWARE	
9.	VP Planner sale!	49.
9.	VP Experi	69.
	PAPERBACK SOFTWARE VP Planner sale! VP Expert SURPASS SOFTWARE-ncp Surpass v1.0 SYMANTEC-ncp 0 & A v2 0	299
	SYMANTEC-DCD	.200.
5. 2.	Q & A v2.0	.219.
••	Q & A Write	.139.
3.	Q & A V2.0 Q & A Write Grand View TRAVELING SOFTWARE	.175.
	TRAVELING SOFTWARE Laplink Plus	86
9.	TURNER HALL-DOD	00.
4.	TURNER HALL-ncp SQZ! Plus	65.
2	SOZ! Plus Note-it Plus(Lotus123 notes) Cambridge Spreadsheet Anlst. 4Word (123 Wordprocessing) XEROX	. 55.
2.	Cambridge Spreadsheet Anlst	. 75.
5.	4vvoru (123 wordprocessing)	. 65.
I.	Ventura	400
	WORDPERFFCT-ncn	.400.
3. 9. 9.	WORDPERFECT-ncp WordPerfect v5.0 WordPerfect Library v1.1 WordPerfect Executive DataPerfect v2.0	.240.
9.	WordPerfect Library v1.1	. 65.
Э.	WordPerfect Executive	125.
9.	Datai cilett VZ.U	. 233.



INPUT DEVICES

Advanced PC Keyboards 5160 84key XT/ATswitchable . . . 59. 5161 101key XT/ATswitchable . . . 79.

 CH Products

 Mach II Joystick-IBM
 39.

 Mach II Joystick-Apple
 39.

#### Advanced Computer Products, Inc.

Mail Order: P.O. Box 17329 Irvine, CA 92713 Retail: 1310-B E. Edinger, Santa Ana, CA 92705

for Fast Service Order by Phone!

**NEW PHONE FOR ALL USA** 800-FONE ACP 800-366-3227 • 714-558-8813

KENSINGTON

P15 Power Director P25 4 outlet stand alone F20 Print Saver A200 PC Data Display Module

 Masterpiece Power Center
 98.

 Masterpiece Pius
 108.

 System Saver IIe
 69.

MasterCard VISA' \$25.00 Minimum MAIL ORDER
No Surcharge for VISA or Mastercard
Volume purchasing agreements available • Orders subject to availability
Pricing subject to change without notice • Supply limitled on certain items
ACP Retail store pricing may vary. Not responsible for typos.
Limited warranties and other conditions may apply.

Call for our NEW 1988 Catalog...

## PR Microdevi

■ 30 DAY MONEY BACK GUARANTEE ■ 1 YEAR WARRANTY ON ALL PRODUCTS ■ TOLL-FREE TECHNICAL SUPPORT

ST				

PART	SIZE	SPEED	PRICE
2112	256x4	450ns	2.99
2114	1024x4	450ns	.99
2114L-2	1024x4	200ns	1.49
TC5516	2048x8	250ns	3.95
TMM2016-200	2048x8	200ns	3.25
TMM2016-150	2048x8	150ns	3.29
TMM2016-100	2048x8	100ns	4.29
HM6116-4	2048x8	200ns	4.95
HM6116-3	2048x8	150ns	5.95
HM6116-2	2048x8	120ns	6.45
HM6116LP-4	2048x8	200ns	5.95
HM6116LP-3	2048x8	150ns	6.45
HM6116LP-2	2048x8	120ns	6.95
HM6264LP-15	8192x8	150ns	9.95
HM6264LP-12	8192x8	120ns	10.95
HM43256LP-15	32768x8	150ns	12.95
HM43256LP-12	32768x8	120ns	14.95
HM43256LP-10	32768x8	100ns	19.95

#### DYNAMIC RAMS

PART	SIZE	SPEED	PRICE
4116-200	16384x1	200ns	.89
4116-150	16384x1	150ns	.99
MK4332	32768x1	200ns	6.95
4164-150	65536x1	150ns	2.89
4164-120	65536x1	120ns	3.19
4164-100	65536x1	100ns	3.95
TMS4164	65536x1	150ns	2.89
TMS4416	16384x4	150ns	8.95
41128-150	131072x1	150ns	5.95
TMS4464-15	65536x4	150ns	10.95
TMS4464-12	65536x4	120ns	11.95
41256-150	262144x1	150ns	12.45
41256-120	262144x1	120ns	12.95
41256-100	262144x1	100ns	13.45
41256-80	262144x1	80ns	13.95
HM51258-100	262144x1	100ns	13.95
1 MB-120	1048576x1	120ns	34.95
1 MB-100	1048576x1	100ns	37.95

CALL TO CONFIRM CURRENT PRICES

#### **EPROMS**

PART	SIZE	SPEED	Vpp	PRICE
2708	1024x8	450ns	25V	4.95
2716	2048x8	450ns	25V	3.49
2716-1	2048x8	350ns	25V	3.95
2732	4096x8	450ns	25V	3.95
2732A	4096x8	250ns	21V	3.95
27C64	8192x8	250ns	12.5V	4.95
2764	8192x8	450ns	12.5V	3.49
2764-250	8192x8	250ns	12.5V	3.69
2764-200	8192x8	200ns	12.5V	4.25
MCM68766	8192x8	350ns	21V	15.95
27128	16384x8	250ns	12.5V	4.95
27128A-200	16384x8	200ns	12.5V	5.95
27C256	32768x8	250ns	12.5V	7.95
27256	32768x8	250ns	12.5V	5.95
27256-200	32768x8	200ns	12.5V	7.95
27512	65536x8	250ns	12.5V	11.95
27C512	65536x8	250ns	12.5V	12.95
27C101-20	131072X8	200ns	12.5V	34.95

CALL TO CONFIRM CURRENT PRICES

#### CO-PROCESSORS

8087	5 MHz	99.95
8087-2	8 MHz	159.95
8087-1	10 MHz	229.95
80287	6 MHz	179.95
80287-8	8 MHz	249.95
80287-10	10 MHz	309.95
80387-16	16 MHz	499.95
80387-20	20 MHz	799.95
80387-25	25 MHz	999.95



YEAR WARRANTY

INCLUDES MANUAL & SOFTWARE GUIDE

#### CALL FOR VOLUME QUOTES ORDER TOLL FREE

#### MICROPROCESSORS

65	00	80	00	820	10
6502	2.25	8031	3.95	8253-5	1.95
6502A	2.69	8035	1.49	8254	2.79
6502B	4.25	8039	1.95	8255	1.49
65C02*	7.95	8052AH		8255-5	1.59
6520	1.65	BASIC	34.95	8256	15.95
6522	2.95	8080	2.49	8259	1.95
6522A	5.95	8085	1.95	8259-5	2.29
6526	13.95	8085A-2	3.75	8272	4.39
6532	5.95	8086	6.49	8274	4.95
6545A	3.95	8088	5.99	8275	16.95
6551	2.95	8088-1	12.95	8279	2.49
6551A	6.95	8088-2	7.95	8279-5	2.95
· CMOS		8155	2.49	8282	3.95
		8156	2.95	8283	3.95
		8155-2	3.95	8284	2.25
		8741	9.95	8286	3.95
		8742	29.95	8287	3.95
~~~	~	8748	7.95	8288	4.95
bb	00	8749	9.95		
cooo	1.95	8755	14.95		
6800 6802	2.95	80286	79.95	707 67	70
6802	3.95	80286-8	249.95	Z-8	S L J
6809	2.95			Z80-CPU	1.25
68B09	5.99	~	<i>(7) (7)</i>	Z80-CPU	
6809E	2.95	82		Z80B-CPU	
68B09E	5.49	8205	3.29	Z80A-CTC	
6810	1.95	8212	1.49	Z80B-CTC	
6820	2.95	8216	1.49	Z80A-DAF	
6821	1.25	8224	2.25	Z80B-DAF	
68B21	1.85	8228	2.25	Z80A-DMA	
6840	3.95	8237	3.95	Z80A-PIO	1.89
6845	2.75	8237-5	4.75	Z80B-P10	4.25
68B45	4.95	8238	4.49	Z80A-SIO	
6847	4.75	8243	1.95	Z80B-SIO/	
6850	1.95	8250	6.95	Z80A-SIO	
68B50	1.75	8251	1.29	Z80A-SIO	
6883	22.95	8251A	1.69	Z80B-SIO	
68000	9.95	8253	1.59	Z8671BAS	

## HIGH-YECK

#### SCSI HOST ADAPTOR \$49.95

A LOW POWER, SHORT SLOT CARD FOR PC COMPATIBLES THAT CAN CONTROL UP TO SEVEN SCSI DEVICES.THIS POPULAR STANDARD OFFERS SPEED, EXPANDABILITY AND THE ADVANTAGES OF USING A DEVICE INDEPENDENT BUS. INCLUDES CABLES. MCT-SCSI

#### V-20 SERIES

SPEED UP YOUR PC BY 10 TO 40%! HIGH SPEED ADDRESS CALCULATION IN HARDWARE PIN COMPATIBLE WITH 8088

SUPERSET OF 8088 INSTRUCTION SET

V20*	10 MHz		V30	8 MHz	
V20*	5 MHz	8.95	V20*	8 MHz	10 95

#### **VOLTAGE REGULATORS**

7805T	.49	7812K	1.3
7808T	.49	7905K	1.6
7812T	.49	7912K	1.4
7815T	.49	78L05	.4
7905T	.59	78L12	.4
7908T	.59	79L05	.6
7912T	.59	79L12	1.4
7915T	.59	LM323K	3.4
7805K	1.59	LM338K	4.4

#### MISCELLANEOUS

ADC0804	2.99	9334	1./5
ADC0809	3.85	9368	2.85
DAC0800	3.29	9602	.69
DAC0808	1.95	ULN2003	.79
DAC1022	5.95	<b>MAX232</b>	7.95
MC1408L8	1.95	MC3470	1.95
8T28	1.29	MC3487	2.95
8T97	.59	AY5-3600	
DP8304	2.29	PRO	11.95

#### PAL5 16L8 16R8 16R6 2.95 2.95

THE OWNER OF THE OWNER OWNER OF THE OWNER	THE REAL PROPERTY.		
UAR	3-1015 4.95 1602 3.95 1 4.95 402 3.95 403 9.95		
AY5-1013	3.95		
AY3-1015	4.95		
TR1602	3.95		
2651	4.95		
IM6402	3.95		
IM6403	9.95		
INS8250	6.95		
NS16450	10.95		

#### INTERSIL 10.95 1.99 3.85 5.95 15.95 ICL7107 ICL7660 ICL7660 ICL8038 ICM7207A ICM7208

#### **30 DAY MONEY-BACK GUARANTEE** TOLL-FREE TECHNICAL SUPPORT

#### 74L500 TTL LOGIC

74LS00	.16	74LS112	.29	74LS241	.69
74LS01	.18	74LS122	.45	74LS242	.69
74LS02	.17	74LS123	.49	74LS243	.69
74LS03	.18	74LS124	2.75	74LS244	.69
74LS04	.16	74LS125	.39	74LS245	.79
74LS05	.18	74LS126	.39	74LS251	.49
74LS08	.18	74LS132	.39	74LS253	.49
74LS09	.18	74LS133	.49	74LS257	.39
74LS10	.16	74LS136	.39	74LS258	.49
74LS11	.22	74LS138	.39	74LS259	1.29
74LS12	.22	74LS139	.39	74LS260	.49
74LS13	.26	74LS145	.99	74LS266	.39
74LS14	.39	74LS147	.99	74LS273	.79
74LS15	.26	74LS148	.99	74LS279	.39
74LS20	.17	74LS151	.39	74LS280	1.98
74LS21	.22	74LS153	.39	74LS283	.59
74LS22	.22	74LS154	1.49	74LS290	.89
74LS27	.23	74LS155	.59	74LS293	.89
74LS28	.26	74LS156	.49	74LS299	1.49
74LS30	.17	74LS157	.35	74LS322	3.95
74LS32	.18	74LS158	.29	74LS323	2.49
74LS33	.28	74LS160	.29	74LS365	.39
74LS37	.26	74LS161	.39	74LS367	.39
74LS38	.26	74LS162	.49	74LS368	.39
74LS42	.39	74LS163	.39	74LS373	.79
74LS47	.75	74LS164	.49	74LS374	.79
74LS48	.85	74LS165	.65	74LS375	.95
74LS51	.17	74LS166	.95	74LS377	.79
74LS73	.29	74LS169	.95	74LS390	1.19
74LS74	.24	74LS173	.49	74LS393	.79
74LS75	.29	74LS174	.39	74LS541	1.49
74LS76	.29	74LS175	.39	74LS624	1.95
74LS83	.49	74LS191	.49	74LS640	.99
74LS85	.49	74LS192	.69	74LS645	.99
74LS86	.22	74LS193	.69	74LS670	.89
74LS90	.39	74LS194	.69	74LS682	3.20
74LS92	.49	74LS195	.69	74LS688	2.40
74LS93	.39	74LS196	.59	74LS783	22.95
74LS95	.49	74LS197	.59	25LS2521	2.80
74LS107	.34	74LS221	.59	26LS31	1.95
74LS109	.36	74LS240	.69	26LS32	1.95

#### I INICAD COMBONICATE

		MA LUIVI	i Cui	VICIVII 5	
TL071	.69	LM380	.89	XR2206	3.95
TL072	1.09	LM383	1.95	XR2211	2.95
TL074	1.95	LM386	.89	LM2917	1.95
TL081	.59	LM393	.45	CA3046	.89
TL082	.99	LM394H	5.95	CA3146	1.29
TL084	1.49	LM399H	5.95	MC3373	1.29
LM301	.34	TL494	4.20	MC3470	1.95
LM309K	1.25	TL497	3.25	MC3480	8.95
LM310	1.75	NE555	.29	MC3487	2.95
LM311	.59	NE556	.49	LM3900	.49
LM311H	.89	NE558	.79	LM3909	.98
LM311K	3.49	NE564	1.95	LM3911	2.25
LM312H	1.75	LM565	.95	LM3914	1.89
LM317T	.69	LM566	1.49	LM3915	1.89
LM318	1.49	LM567	.79	MC4024	3.49
LM319	1.25	NE570	2.95	MC4044	3.99
LM323K	3.49	NE590	2.50	RC4136	1.25
LM324	.34	NE592	.98	RC4558	.69
LM331	3.95	LM723	.49	LM1360	1.49
LM334	1.19	LM733	.98	75107	1.49
LM335	1.79	LM741	.29	75108	1.49
LM336	1.75	LM747	.69	75110	1.95
LM338K	4.49	MC1330	1.69	75150	1.95
LM339	.59	MC1350	1.19	75154	1.95
LF347	2.19	LM1458	.35	75188	1.25
LF353	.59	LM1488	.49	75189	1.25
LF356	.99	LM1489	.49	75451	.39
LF357	.99	LM1496	.85	75452	.39
LM358	.59	ULN2003	.79	75477	1.29

#### HIGH SPEED CMOS LOGIC

7411000	.21	74110244	.00	741101130	.33
74HC04	.25	74HC245	.85	74HCT139	.55
74HC08	.25	74HC273	.69	74HCT157	.59
74HC14	.35	74HC367	.69	74HCT161	.79
74HC32	.35	74HC373	.69	74HCT240	.89
74HC74	.35	74HC390	.79	74HCT244	.89
74HC138	.45	74HC374	.69	74HCT245	.99
74HC139	.45	74HC4040	.89	74HCT273	.99
74HC154	1.09	74HCT00	.25	74HCT373	.99
74HC157	.55	74HCT04	.27	74HCT374	.99
74HC161	.65	74HCT08	.25	74HCT393	.99
74HC164	.65	<b>74HCT32</b>	.27	74HCT4040	.99
74HC175	.59	74HCT74	.45	74HCT4060	1.49

#### STANDARD CMOS LOGIC

4001	.19	4028	.65	4069	.19
4011	.19	4040	.69	4070	.29
4013	.35	4042	.59	4081	.22
4015	.29	4044	.69	4093	.49
4016	.29	4046	.69	14411	9.95
4017	.49	4047	.69	14433	14.95
4018	.69	4049	.29	14497	6.95
4020	.59	4050	.29	4503	.49
4021	.69	4051	.69	4511	.69
4023	.25	4052	.69	4518	.85
4024	.49	4053	.69	4528	.79
4025	.25	4060	.69	4538	.95
4027	.39	4066	.29	4702	9.95

#### 7400 SERIES LOGIC

74	00	74121	.29	74F240	1.29
7400	.19	74123	.49	74500	.29
7402	.19	74125	.45	74502	.29
7404	.19	74150	1.35	74504	.29
7406	.29	74151	.55	74508	.35
7407	.29	74153	.55	74510	.29
7408	.24	74154	1.49	74532	.35
7410	.19	74157	.55	74574	.49
7411	.25	74159	1.65	74586	.35
7414	.49	74161	.69	745112	.50
7416	.25	74164	.85	745124	2.75
7417	.25	74166	1.00	745138	.79
7420	.19	74175	.89	74S153	.79
7430	.19	74367	.65	74S157	.79
7432	.29			74S158	.95
7438	.29	74F/7	745	74S163	1.29
7442	.49	74F00	.35	74S175	.79
7445	.69	74F02	.35	74S195	1.49
7447	.89	74F04	.35	74S240	1.49
7473	.34	74F08	.35	74S241	1.49
7474	.33	74F10	.35	745244	1.49
7475	.45	74F32	.35	74S280	1.95
7476	.35	74F64	.55	74S287	1.69
7483	.50	74F74	.39	745288	1.69
7485	.59	74F86	.55	74S299	2.95
7586	.35	74F138	.79	74S373	1.69
7489	2.15	74F139	.79	74S374	1.69
7490	.39	74F253	.89	745471	4.95
7493	.35	74F157	.89	74S571	2.95

JDR MICRODEVICES AND THE JDR MICRODEVICES LOGO ARE REGISTERED TRADEMARKS OF JDR MICRODEVICES. IBM, AT, PS/2 ARE TRADEMARKS OF INTERNATIONAL BUSINESS MACHINES.

**CRYSTALS** 32,768 KHz 95 1.0 MHz 1.8432 2.0 2.4576 1.95 3.579545 1.95 1.95 1.95 1.95 1.95 1.95 1.95 4.0 5.0688 6.0 6.144 10.0 10.738635 1.95 1.95 1.95 1.95 1.95 1.95 12.0 14.31818 16.0 18.0 18.432 1.95 20.0 1 95 22.1184 1 95 OSCILL) TORS 1.0MHz 1.8432

2.0 2.4576

4.0 5.0 5.0688

6.0 6.144

10.0

16.0

20.0

18.432

12.0 14.31818 15.0

5.95 5.95

5.95 4.95 4.95 4.95 4.95 4.95 4.95

4.95 4.95 4.95 1.95 1.95 4.95

4.95

4 95

DISCRETE .25 1.75 2N6045 IN5402 IN4004 10/1.00 MPS-A13 .40 .49 .69 .69 .89 IN4148 25/1 00 TIP31 KBP02 55 .10 .10 .25 .79 2N2907 4N33 2N3055 4N37 2N3904 MCT-2 59 2N3906 MCT-6

**CAPACITORS** 

ELECTROLYTIC

50V .14 50V .11 50V .11 50V .13 35V .13 16V .15 50V .23 35V .20 25V .30 16V .70 25V 1.45

.14 .16 .14 .19 .19 .29 .29

50V 16V 16V 16V

RADIAI

1μf 4.7 10 47

4700

AXIAL

1μ*f* 10 10 50V 16V 50V

22 47 16V 50V

100 470 1000 2200 35V

TANTALUM

1.0µ*f* 6.8 10 22

1.0µf 2.2 4.7 10

DISC

10pf

33 47

100

.01

.05

220 .001μf .005

15V .12 15V .42 15V .45 15V .99 35V .45 35V .19 35V .39 35V .69

#### **SOLDER STATION**

**UL APPROVED** 

ADJUSTABLE HEAT SETTING TIP TEMPERATURE READOUT REPLACEMENT TIPS AVAILABLE \$2.95

**\$4,9**95

168-2C



## **EVERY PRODUCT**

#### WIREWRAP PROTOTYPE CARDS

FR-4 EPOXY GLASS LAMINATE WITH GOLD PLATED EDGE-CARD FINGERS AND SILK SCREENED LEGENDS.



FOR PS/2

JDR-PR32 32 BIT PROTOTYPE CARD
JDR-PR16 16 BIT WITH JIV DECODING LAYOUT
JDR-PR16PK PARTS KIT FOR JDR-PR16 ABOVE
JDR-PR16V 16 BIT FOR VIDEO APPLICATIONS 69.95 49.95 15.95 39.95 FOR AT JDR-PR10 16BIT WITH I/O DECODING LAYOUT JDR-PR10PK PARTS KIT FOR JDR-PR10 ABOVE 34.95 FOR XT WITH +5V AND GROUND PLANE 27.95 AS ABOVE WITH I/O DECODING LAYOUT 29.95 IBM-PR1 IBM-PR2

#### POWER SUPPLIES

APPLE TYPE SUPPLY

■ APPLE CONNECTOR ■ +5V @ 6A, +12V @ 3A,

-5V @ 1A, -12V @ 1A \$49.95 FLOPPY DRIVE SUPPLY ■ +5V @ 2.5A, +12V @ 2A,

-12V @ 1A ■ +5V @ 5A, IF +12 NOT PS-ASTEC \$24.95

75 WATT SUPPLY ■ UL APPROVED

+5V @ 7A, +12V @ 3A, -5V @ 300MA, -12V @ 250MA PS-1558 \$34.95

MICRO SUPPLY

■ UL APPROVED, 144 WATTS ■ +5V @ 18A, +12V @ 4A, -12V @ 500MA PS-1554 \$29.95

GENDER CHANGERS

GENDER-FF GENDER-MM GENDER-MF GENDER-NM FEMALE-MALE MALE-MALE MALE-FEMALE 7.95 7.95 7.95 8.95 NULL MODEM GENDER-JB GENDER-MT JUMPER BOX MINITESTER 14 95

BIT RATE **GENERATORS** 

MC14411 BR1941 4.95 9.95 COM5016 16.95 8.95 4.95 COM8116 MM5307

BYPASS CAPACITORS

.05 .05 .05 .05 .05 .05 .05 .07

50V

50V 50V 50V 50V 50V

12V

CERAMIC DISC MONOLITHIC CERAMIC DISC .01xx .01xx .1xx .1xx 100/5.00 100/10.00 100/6.50 MONOLITHIC 100/12.50

CLOCK CIRCUITS

MC146818 MM58167 MM58174 MSM5832

#### DISK CONTROLLERS

			6 12.95 7 12.95
1771	4.95	2797	29.95
1791	9.95	8272	4.39
1793	9.95	<b>UPD765</b>	4.39
1795	12.95	MB8876	12.95
1797	12.95	MB8877	12.95
2791	19.95	1691	6.95
2793	19.95	2143	6.95

#### 44GNAPARIE? HEADERS

CAN BE SNAPPED APART TO MAKE ANY SIZE HEADER, ALL WITH .1" CENTERS

STRAIGHT LEAD

1x40 1x40 2x40 2x40 .99 .49 2.49 2.99 RIGHT ANGLE LEAD 2 STRAIGHT LEADS 2 RIGHT ANGLE LEADS 11

#### RS-232 **BREAKOUT BOX**

FOR TROUBLESHOOTING SERIAL COMMUNICATIONS

 OPEN/CLOSE INDIVIDUAL CIRCUITS
 20 JUMPERS CROSS-CONNECT ANY
 TWO CIRCUITS
 10 LEDS SHOW CIRCUIT ACTIVITY \$34.95



**INYSTICK** SET X-Y AXIS FOR AUTO CENTER

OR FREE MOVEMENT

#### IDC CONNECTORS/RIBBON CABLE

DESCRIPTION	ORDER BY	CONTACTS						
		10	20	26	34	40 2.58 2.72 5.28 4.80 1.49 7.50 2.05	50	
SOLDER HEADER	IDHxxS	.82	1.29	1.68	2.20	2.58	3.24	
RIGHT ANGLE SOLDER HEADER	IDHxxSR	.85	1.35	1.76	2.31	2.72	3.39	
WIREWRAP HEADER	IDHxxW	1.86	2.98	3.84	4.50	5.28	6.63	
RIGHT ANGLE WIREWRAP HEADER	IDHxxWR	2.05	3.28	4.22	4.45	4.80	7.30	
RIBBON HEADER SOCKET	IDSxx	.63	.89	.95	1.29	1.49	1.69	
RIBBON HEADER	IDMxx		5.50	6.25	7.00	7.50	8.50	
RIBBON EDGE CARD	IDExx	.85	1.25	1.35	1.75	2.05	2.4	
10' PLASTIC RIBBON CABLE	RCxx	1.60	3.20	4.10	5.40	6.40	7.5	

FOR ORDERING INSTRUCTIONS, SEE D-SUBMINIATURE CONNECTORS BELOW

#### **D-SUBMINIATURE CONNECTORS**

DESCRIPTION	ORDER BY		CONTACTS					
DESCRIPTION	ONDERDI	9	9 15 19 25				50	
SOLDER CUP	MALE	DBxxP	.45	.59	.69	.69	1.35	1.85
SOLDER COP	FEMALE	DBxxS	.49	.69	.75	.75	1.39	2.29
RIGHT ANGLE	MALE	DBxxPR	.49	.69		.79	2.27	
PC SOLDER	FEMALE	DBxxSR	.55	.75		.85	2.49	
WIREWRAP	MALE	DBxxPWW	1.69	2.56		3.89	5.60	
WINEWHAP	FEMALE	DBxxSWW	2.76	4.27		6.84	9.95	
IDC RIBBON CABLE	MALE	IDBxxP	1.39	1.99		2.25	4.25	
IDO MIDDOM CADEL	FEMALE	IDBxxS	1.45	2.05		2.35	4.49	
HOODS	METAL	MHOODxx	1.05	1.15	1.25	1.25		
ПООВЗ	PLASTIC	HOODxx	.39	.39		.39	.69	.75

ORDERING INSTRUCTIONS: INSERT THE NUMBER OF CONTACTS IN THE POSITION MARKED "xx" OF THE "ORDER BY" PART NUMBER LISTED. EXAMPLE: A 15 PIN RIGHT ANGLE MALE PC SOLDER WOULD BE MOUNTING HARDWARE 59¢

#### **EPROM ERASERS**

SPECTRONICS CORPORATION

Model	Timer	# of Chips	lintensity (uW/Cm²)	Unit
PE-140	NO	9	8,000	\$ 89
PE-140T	YES	9	8,000	\$139
PE-240T	YES	12	9,600	\$189



FRASES 2 EPROMS IN 10 MINUTES

VERY COMPACT, NO DRAWER METAL SHUTTER PREVENTS UV LIGHT FROM ESCAPING



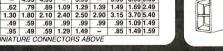
## OR FREE MOVEMENT FIRE BUTTON FOR USE WITH GAME SOFTWARE COMPATIBLE WITH IBM, APPLE II, IIE, IIC, ATARI & VIC 20/64 GC-10 \$**19**95



#### IC SOCKETS/DIP CONNECTORS

DESCRIPTION	ORDER BY			С	ATNO	CTS									
DESCRIPTION	OHDENDI	8	14	16	18	20	22	24	28	40					
SOLDERTAIL SOCKETS	xxST	.11	.11	.12	.15	.18	.15	.20	.22	.30					
WIREWRAP SOCKETS	xxWW	.59	.69	.69	.99	1.09	1.39	1.49	1.69	1.99					
ZIF SOCKETS	ZIFxx	-	4.95	4.95		5.95		5.95	6.95	9.95					
TOOLED SOCKETS	AUGATxxST	.62	.79	.89	1.09	1.29	1.39	1.49	1.69	2.49					
TOOLED WW SOCKETS	AUGATxxWW	1.30	1.80	2.10	2.40	2.50	2.90	3.15	3.70	5.40					
COMPONENT CARRIERS	ICCxx	.49	.59	.69	.99	.99	.99	.99	1.09	1.49					
DIP PLUGS (IDC)	IDPYY	95	.49	.59	1.29	1.49		.85	1.49	1.50					

FOR ORDERING INSTRUCTIONS SEE D-SUBMINIATURE CONNECTORS ABOVE



#### **SHORTING BLOCKS** 5/\$1.00



#### LITHIUM BATTERIES

 6.8V FOR 286/386 COMPUTERS
 MOTHERBOARD CONNECTOR
 ADHESIVE VELCRO STRIP FOR EASY MOUNTING **LITHIUM 6.8V** \$11.95

LITHIUM-3V 3V COIN TYPE LITHIUM BATTERY \$1.95
3V-MHW BATTERY HOLDER \$1.49

TERMS: MINIMUM ORDER \$10.00 FOR SHIPPING AND HANDLING INCLUDE \$2.50 FOR UPS GROUND AND \$3.50 UPS AIR. ORDERS OVER 1 LB. AND FOREIGN ORDERS MAY REQUIRE ADDITIONAL SHIPPING CHARGES—PLEASE CONTACT THE SALES DEPARTMENT FOR THE AMOUNT. CA RESIDENTS MUST INCLUDE APPLICABLE SALES TAX. PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE. WE ARE NOT RESPONSIBLE FOR TYPOGRAPHICAL ERRORS. WE RESERVE THE RIGHT TO LIMIT QUANTITIES AND TO SUBSTITUTE MANUFACTURER. ALL MERCHANDISE SUBJECT TO PRIOR SALE. A FULL COPY OF OUR TERMS IS AVAILABLE UPON REQUEST. ITEMS PICTURED MAY ONLY BE REPRESENTATIVE.



JDR MICRODEVICES, 110 KNOWLES DRIVE, LOS GATOS, CA 95030 LOCAL (408) 866-6200 FAX (408) 378-8927 TELEX 171-110

RETAIL STORE: 1256 SOUTH BASCOM AVE., SAN JOSE, CA (408) 947-8881 HOURS: M-F 10-7 SAT. 9-5 SUN. 12-4

OLL FREE 800-538-

**COPYRIGHT 1988 JDR MICRODEVICES** 

## JDR Microdevid

30 DAY MONEY BACK GUARANTEE \*1 YEAR WARRANTY ON ALL PRODUCTS \*TOLL-FREE TECHNICAL SUPPORT







SAVE TIME AND TELEPHONE CHARGES WITH A HIGH SPEED 2400 BAUD MODEM FROM JDR

#### INTERNAL 2400 BAUD

- AUTO DIAL ANSWEH
  SELF TEST ON POWER-UP
  TOUCHTONE OR PULSE DIALING
  HAYES & BELL SYSTEMS COMPATIBLE
  FULL OR HALF DUPLEX
  MIRROR II COMMUNICATIONS SOFTWARE INCLUDED MCT-24I

1200 BAUD 1/2 CARD \$69.95 MCT-24M 2400 BAUD FOR PS/2

#### EXTERNAL 2400 BAUD

- 2400/1200/300 HAYES COMPATIBLE 8 EASY-TO-READ STATUS LED'S CALL PROGRESS MONITORING & ADJUSTABLE VOLUME 2ND PHONE JACK FOR VOICE COMMUNICATIONS REQUIRES SERIAL PORT & CABLE (OPTIONAL)
- MCT-24F \$169.95
- MCT-12E 1200 BAUD EXTERNAL \$99.95

#### APPLE/MACINTOSH MODEMS

POCKET MODEM

MACINTOSH 2400 BAUD EXTERNAL AS ABOVE WITH CABLE AND PROCOM-M SOFTWARE.

MCT-24FM \$199.95 MCT-24A APPLE II 2400 BAUD MODEM MCT-12A APPLE II1200 BAUD MODEM

\$179.95 \$139.95

\$79.95

#### HANDY SCANNER **\$ 24.9**95

INSTANT SCANNING OF IMAGES UP TO " WIDE

- 100, 200, 300, 400 DPI BOTH DIRECTIONS
- B&W AND 3 HALF-TONE
- HERCULES, CGA AND EGA COMPATIBLE INCLUDES HALO DPE AND IMAGE EDITOR SOFTWARE

LOGITECH HIREZ *MOUSE* 



#### LOGITECH 3-BUTTON MOUSE

PC MAGAZINE EDITORS CHOICE! ALL MODELS HAVE SERIAL SUPPORT (COM1/COM2), 200 D.P.I. RESOLUTION, LOTUS 1.2-3 SHELL, SELF-INSTALLING SOFTWARE AND "POINT EDITOR"

LMOUSE \$79.95 SERIAL MOUSE W/LOGIPAINT \$99.95 LMOUSE-BP BUS MOUSE W/LOGIPAINT \$99.95 LMOUSE-BPL BUS MOUSE W/PUBLISHER PKG \$139.95 LMOUSE-BPC BUS MOUSE W/LOGIPAINT/CAD

> CALL OUR 24-HOUR BBS: (408) 374-2171

FOR TECHNICAL SUPPORT, CONFERENCING, TIPS AND MORE

## CITIZEN PRINTER

A RELIABLE, FAST AND INEXPENSIVE ALL PURPOSE PRINTER THAT'S LOADED WITH FEATURES

- 9 PIN DOT MATRIX PRINT HEAD 180 CPS DRAFT MODE, 29 CPS NLQ MODE CENTRONICS PARALLEL INTERFACE, SERIAL OPTIONAL DUAL PITCH, DOUBLESTRIKE, ITALICS & SUPERSCRIPT CRONDEY & IDM GRADUICS
- **EPSON FX & IBM GRAPHICS**
- COMPRESSED, EXPANDED & EMPHASIZED PRINT DOT ADDRESSABLE GRAPHICS IN SIX DENSITIES
- CITIZEN-180D

REPLACEMENT RIBBON CARTRIDGE 6.95

#### **KEYBOARDS**

#### MODULAR CIRCUIT TECHNOLOGY

■ 1200/300 BAUD ■ BATTERY & AC POWER
■ SERIAL INTERFACE (DB25) ■ 4 STATUS INDICATORS

YOU'LL NEVER BE FAR FROM YOUR DATA WITH THIS 6 OUNCE HAND-HELD POCKET MODEM

ENHANCED STYLE LAYOUT

AUTOSENSE FOR XT OR AT COMPATIBLES

LED INDICATORS AUTO REPEAT FEATURE

SEPARATE CURSOR PAD

MCT-5339

84 KEY LAYOUT

■ SOFTWARE AUTOSENSE FOR XT OR AT COMPATIBLES
■ LED INDICATORS ■ AUTO REPEAT \$59.95

#### MAXI-SWITCH KEYBOARDS

WITH TACTILE FEEDBACK MAX-5339 ENHANCED STYLE LAYOUT \$84.95 MAX-5060 84 KEY LAYOUT

#### AUDIBLE "CLICK" KEYBOARD

ENHANCED STYLE, 101 KEY KEYBOARD LED INDICATORS ■ AUTO REPEAT

K-103-A

#### **MOLDED CABLES**

**CBL-PRINTER** PC PRINTER CABLE \$9.95 CBL-PRINTER-25 AS ABOVE - 25 FOOT \$15.95 CBL-PRINTER-RA RIGHT ANGLE PRINTER \$15.95 CBL-DB25-MM CBL-DB25-MF DB25 MALE TO DB25 MALE \$9.95 DB25 MALE TO DB25 FEMALE \$9.95 **CBL-9-SERIAL** 9 PIN TO 25 PIN SERIAL \$6.95 CBL-KBD-EXT KEYBOARD EXTENSION \$7.95 CBL-CNT-MM CBL-HD-20 36 PIN CENTRONICS-M/M \$14.95 \$3.95 \$4.95 20 PIN HARD DISK CARLE CBL-HD-34 34 PIN HARD DISK CABLE CBL-HD-34D 34 PIN DUAL HARD DISK \$6 95 CBL-FDC-EXT 37 PIN EXTERNAL FLOPPY

#### VGA COMPATIBLE PACKAGE

- MAXIMUM
- MAXIMUM RESOLUTION 640 X 480 IN 16 COLORS 320 X 200 IN 256 COLORS
- IBM STYLE ANAL OG
- MONITOR FULLY VGA, EGA, CGA, HERCULES & MONOCHROME COMPATIBLE



#### NECMULTISYNCII

\$599.95

\$39.95

■ AUTO FREQUENCY ADJUSTMENT ■ RESOLUTION AS HIGH AS 800 X560

#### CASPER EGA

\$399.95

- 640 X 200/350 RESOLUTION■ .31 MM DOT PITCH 14" BLACK MATRIX SCREEN■ 16 COLORS

#### CASPER RGB

■ COLOR GREEN AMBER SWITCH ■ .39MM DOT PITCH ■ 640 X 240 RESOLUTION ■ 14" NON-GLARE SCREEN

\$129.95 SAMSUNG MONO

#### 12" NON-GLARE LOW DISTORTION AMBER SCREEN 720 X 350 RESOLUTION ■ SWIVEL BASE

#### MONITOR STANDS

MODEL MS-100 MODEL MS-200

■ TILTS AND SWIVELS ■ BUILT-IN SURGE SUPRESSOR INDEPENDENTLY CONTROLS UP TO 5 AC OUTLETS

#### **TOWER CASE \$299**95

SAVE DESKSPACE AND ADD STYLE TO YOUR OFFICE WITH THIS SLEEK UPRIGHT DESIGN

- ACCOMODATES ALL
- ACCOMODATES ALL
  SIZES OF MOTHERBOARDS
  250 WATT POWER SUPPLY
  INCLUDED
  MOUNTS FOR 3 FLOPPY
  & 4 HARD DRIVES
- & 4 HAHD DHIVES
  TURBO & RESET SWITCH
  SPEED DISPLAY, POWER
  & DISK LED'S
  MOUNTING HARDWARE,
  FACEPLATES & SPEAKER
  INCLUDED
- INCLUDED **CASE-100**

CASE-FLIP

FOR 8088 MOTHERBOARDS CASE-SLIDE FOR 8088 MOTHERBOARDS FOR 286 MOTHERBOARDS CASE-70 MINI-286 W/POWER SUPPLY

\$39.95 \$89.95 \$149.95

#### POWER SUPPLIES

\$69.95

\$89.95

**135 WATT** UL APPROVED IBM XT COMPATIBLE

+5V .15A, +12V 4.2A -5V .5A, -12V .5A

PS-150 150W MODEL

200 WATT

U.L. APPROVED

IBM AT COMPATIBLE

+5V 22A, +12V 8A,
-5V .5A, -12V .5A

PS-200 PS-250 250 WATT MODEL \$129.95

JOR MICRODEVICES AND THE JOR MICRODEVICES LOGO ARE REGISTERED TRADEMARKS OF JOR MICRODEVICES. IBM, AT, PS/2 ARE TRADEMARKS OF INTERNATIONAL BUSINESS MACHINES.

1.44 MB 31/2" DRIVE 95

ULTRA HIGH DENSITY ALSO WORKS WITH 720K DISKS FDD-1 44X BLACK FACEPLATE FDD-1.44A BEIGE FACEPLATE

1/2 HEIGHT FLOPPY DISK DRIVES

FD-55B	5-1/4" TEAC DS/DD 360K	\$99.95
FD-55G	5-1/4" TEAC DS/HD 1.2M	\$129.95
M2551A	5-1/4" FUJITSU DS/DD 360K	\$89.95
M2553K	5-1/4" FUJITSU DS/HD 1.2M	\$119.95
FDD-360	5-1/4" DS/DD 360K	\$69.95
FDD-1.2	5-1/4" DS/HD 1.2M	\$109.95
FDD-3.5A	3-1/2" MITSUBISHI DS/DD(BEIGE)	\$129.95
FDD-3.5X	3-1/2" MITSUBISHI DS/DD(BLACK)	\$129.95

TAPE BACK-UP DRIVES

AR5240X	ARCHIVE TAPE DRIVE -XT'S & AT'S	\$369.95
AR5540A	FASTER TAPE DRIVE -AT'S ONLY	\$369.95
AR340	40 MB TAPE CARTRIDGES	\$24.95

#### **DISKETTES**

N-MD2D	BOX OF 10 5-1/4" 360K DS/DD	\$6.95
N-MD2H	BOX OF 10 5-1/4" 1.2 MB DS/HD	\$13.95
N-3.5DS	BOX OF 10 3-1/2" 720K DS/DD	\$16.95
N-3.5HD	BOX OF 10 3-1/2" 1.44 MB DS/HD	\$49.95
N-MD2DBULK	( 360K DS/DD (MIN. 50 DISKS)	EA. 49¢

#### **DONIE ACCESSORIES**

ESSER WILL /		
FD-ARAIL	MTG. RAILS FOR AT COMPATIBLE	\$2.95
FD-55FP	BEIGE FACEPLATE FOR TEAC DRIVES	\$2.95
	HALF-HEIGHT MOUNTING HARDWARE	\$2.95
FD-5Y	Y-POWER ADAPTOR FOR DRIVES	\$2.95



	85	Sea	gate	Whatev high qu availab control	RD L er your hal lality Seaga le. Buy the ler for ever	DISKS rd disk nee ate drives a m alone, on n greater sa	ds, we hant the lower with an Markings!	st prices		-576
0				AVG.		DRIVE	И	VITH MCT	CONTROL	LER
28		SIZE	MODEL	SPEED	HEIGHT	ALONE	HDC	RLL	AFH	AFH-RLL
		20MB	ST-225	65 ms	Half	\$225	\$269	-	\$339	- ,
		30MB RLL	ST-238	65 ms	Half	\$249	-	\$299	-	\$389
		40MB	ST-251	40 ms	Half	\$429	\$469	-	\$539	-
VE5		40MB	ST-251-1	28 ms	Half	\$529	\$569	-	\$639	-
\$99.95		60MB RLL	ST-277	40 ms	Half	\$499	-	\$549	-	\$639
\$129.95		30MB	ST-4038	40 ms	Full	\$559	\$603		\$659	-
\$89.95 \$119.95		80MB	ST-4096	28 ms	Full	\$895	\$939	-	\$995	

INBOARD 386/PC



UPGRADE YOUR XT TO A 386 FOR LESS THAN \$900

16 MHZ PROCESSOR REPLACES 8088

1 MB MEMORY INSTALLED

EXPAND TO 3 MB WITH PIGGYBACK CARD

5 YEAR WARRANTY

PCIB 1200

PIGGYBACK MEMORY BOARDS

I MB INSTALLED PCIR1210 2 MB INSTALLED \$649 00

**NEW!! SIGMA VGA CARD** 





100% REGISTER COMPATIBLE VGA DISPLAY CARD

0% REGISTER COMPATIBLE VGA DISPLAY CARD
VGA, EGA, CGA, HGC & MDA COMPATIBLE
320 X 200 IN 256 COLORS
640 X 480, 800 X 500 IN 16 COLORS
80 X 25, 132 X 44 TEXT MODES
SUPPORTS STANDARD DIGITAL & ANALOG MONITORS

UTILITY SOFTWARE INCLUDED

#### INTERFACE CAR BY MODULAR CIRCUIT TECHNOLOGY

#### DRIVE CONTROLLERS

FI OPPY DISK CONTROLLER 529.95

SINGLE SLOT CONTROL OF 4 FLOPPIES

INTERFACES UP TO 4 FDD'S TO AN IBM PC OR COMPATIBLE ■ SUPPORTS DS/DD AND DS/QD W/ DOS 3.2

1.2 MR FI OPPY CONTROL I FR \$69.95

ADD VERSATILITY AND CAPACITY TO YOUR XT
SUPPORTS 2 DRIVES, CAN MIX 360K AND 1.2 MB
ALLOWS DATA TO FLOW FREELY FROM XT'S TO AT'S MCT-FDC-1.2

FLOPPY/HARD CONTROLLER \$139.95

XT SYSTEM SHORT OF SLOTS? THIS CARD FREES ONE UP!
INTERFACES UP TO 2 FDD'S & 2 HDD'S, CABLING FOR 2
FDD/1HDD SUPPORTS BOTH DS/DD & DS/QD W/DOS 3.2

\$149.95 286/386 FLOPPY/HARD

FLOPPY/ HARD DISK CONTROL IN A TRUE AT DESIGN
SUPPORTS UP TO 2 360K /720K/ 1.2 MB FDD'S
SUPPORTS 2 HDD'S USING STANDARD TABLES

HARD DISK CONTROLLER

HARD DISK CONTROL AT AN ECONOMICAL PRICE

SUPPORTS 16 DRIVE SIZES INCLUDING 10,20,30

DIVIDE 1 LARGE DRIVE INTO 2 LOGICAL DRIVES

**事们** 05 RLL CONTROLLER

TRANSFER DATA 50% FASTER

SUPPORTS UP TO 2 RLL HARD DRIVES

DESIGNED FOR XT COMPATIBLES

286/386 FLOPPY/HARD RLL

IMPROVE SPEED AND STORAGE OF YOUR AT COMPATIBLE
SUPPORTS UP TO 2 RLL HARD DISCS AND 2 FLOPPIES
SUPPORTS 360/720/ 1.2 MB FLOPPIES IN 5.25" & 3.5" MCT-AFH-RLL

#### MULTIFUNCTION CARDS

MUITIUN FLOPPY CONTROLLER \$79.95

A PERFECT COMPANION FOR OUR MOTHERBOARDS

SUPPORTS UP TO TWO 360K FLOPPIES, 720K W/ DOS 3.2

SERIAL, PARALLEL, GAME PORT, CLOCK/CALENDAR MIO-SERIAL -2ND SERIAL PORT

MULTI I/O CARD \$59.95

USE WITH MCT-FH FOR MINIMUM OF SLOTS USED

SERIAL PORT, CLOCK/ CALENDAR WITH BATTERY
PARALLEL PORT ADDRESSABLE AS LPT1 OR LPT2 MCT-IO

286/386 MULTIFUNCTION 5139.95

ADDS UP TO 3 MB OF RAM TO YOUR AT

USER EXPANDABLE TO 1.5 MB OR 3 MB WITH OPTIONAL
PIGGYBACK BOARD (OK INSTALLED) INCLUDES SERIAL AND PARALLEL PORT MCT-AME

MCT-AMF-MC PIGGYBACK BOARD AMF-SERIAL 2ND SERIAL PORT

285/385 MIJITI UN CARN \$59.95

USE WITH MCT-AFH MINIMUM OF SLOTS USED

SERIAL. PARALLEL AND GAME PORTS ■ USES 16450 SUPPORT CHIPS FOR HIGH SPEED OPS MCT-AIO
AIO-SERIAL 2ND SERIAL PORT \$24.95

MEMORY CARDS

576K RAM CARD \$59.95

A CONTIGUOUS MEMORY SOLUTION IN A SHORT SLOT

USER SELECTABLE CONFIGURATION UP TO 576K

USES 64K & 256K RAM CHIPS (ØK INSTALLED) MCT-RAM

EXPANDED MEMORY CARD 5129.95

ZMB OF LOTUS INTEL MICROSOFT MEMORY FOR AN XT
CONFORMS TO LOTUS INTEL EMS USER EXPAND
ABLE TO 2 MB CAN BE USED AS EXPANDED OR
CONVENTIONAL MEMORY, RAMDISK AND SPOOLER MCT-FMS

MCT-AEMS 286/386 VERSION

#### DISPLAY ADAPTORS MONOCHROME GRAPHICS \$59.95

TRUE HERCULES COMPATIBILITY SUPPORTS LOTUS 1-2-3
PARALLEL PRINTER PORT CONFIGURES AS LPT1 OR
LPT2 USES VLSI CHIPS TO ENSURE RELIABILITY MCT-MGP

FISA ANAPTOR

6149 95 100% IBM COMPATIBLE PASSES IBM EGA DIAGNOSTICS

256K OF VIDEO RAM ALLOWS 640 X 350 IN 16 OF 64
COLORS © COMPATIBLE WITH COLOR AND MONOCHROME ADAPTORS © HERICULES COMPATIBLE

COLOR GRAPHICS ADAPTOR \$49.95

COMPATIBLE WITH IBM GRAPHICS STANDARDS

SUPPORTS RGB, COLOR, & COMPOSITE MONOCHROME

640/320 X 200 RESOLUTION, LIGHT PEN INTERFACE MCT-CG

MONOGRAPHICS MULTI I/O 5119.75

TOTAL SYSTEM CONTROL FROM A SINGLE SLOTI

CTRL 2 FLOPPIES, SERIAL, PARALLEL, GAME PORT,
CLOCK CAL RUN COLOR GRAPHICS SOFTWARE ON A MONOCHROME MONITOR MCT-MGMI0

286/386 MONOGRAPHICS I/O

VIDEO DISPLAY AND I/O FUNCTIONS IN ONE CARD

720 X 348 RESOLUTION, 80 & 132 COLUMN TEXT

PARALLEL , SERIAL & GAME PORTS

MCT-MGAIO





JDR MICRODEVICES, 110 KNOWLES DRIVE, LOS GATOS, CA 95030 LOCAL (408) 866-6200 FAX (408) 378-8927 TELEX 171-110

RETAIL STORE: 1256 SOUTH BASCOM AVE., SAN JOSE, CA (408) 947-8881 HOURS: M-F 10-7 SAT. 9-5 SUN. 12-4

TERMS: MINIMUM ORDER \$10.00 FOR SHIPPING AND HANDLING INCLUDE \$2.50 FOR UPS GROUND AND \$3.50 UPS AIR. ORDERS OVER 1 LB. AND FOREIGN ORDERS MAY REQUIRE ADDITIONAL SHIPPING CHARGES—PLEASE CONTACT THE SALES DEPARTMENT FOR THE AMOUNT. CA RESIDENTS MUST INCLUDE APPLICABLE SALES TAX. PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE. WE ARE NOT RESPONSIBLE FOR TYPOGRAPHICAL ERRORS. WE RESERVE THE RIGHT TO LIMIT QUANTITIES AND TO SUBSTITUTE MANUFACTURER. ALL MERCHANDISS SUBJECT TO PRIOR SALE. A FULL COPY OF OUR TERMS IS AVAILABLE UPON REQUEST. ITEMS PICTURED MAY ONLY BE REPRESENTATIVE.

FREE 800-538-!

**COPYRIGHT 1988 JDR MICRODEVICES** 

CONTINENTAL U.S. AND CANADA

## BUILD YOUR OWN SYSTEM!

OVER 20,000 JDR SYSTEMS HAVE ALREADY BEEN BUILT. EASY TO ASSEMBLE IN JUST 2 HOURS WITH A SCREWDRIVER. SAVE MONEY AND LEARN MORE ABOUT YOUR COMPUTER AT THE SAME TIME!



#### **VIDEO INSTRUCTIONS**

\$4<sup>95</sup> WITH KIT PURCHASE

A JDR EXCLUSIVE 20-MIN. VHS OR BETA TAPE SHOWS YOU STEP-BY-STEP HOW TO BUILD AN XT COMPATIBLE

## 12 MHz MINI-286

■ 12 MHZ MINI-286 MOTHERBOARD ■ 512K RAM MEMORY ■ MINI CASE WITH POWER SUPPLY ■ 84 KEY KEYBOARD ■ MONOCHROME MONITOR ■ 1.2 MB FLOPPY DRIVE ■ FLOPPY : HARD CONTROL **■** GRAPHICS ADAPTOR

#### 10 MHz TURBO RORR 5*6*100

■ INCLUDES SERIAL PORT, 2 PARALLEL PORTS, CLOCK/ ■ INCLUDES SEHIAL POHT, 2 PARALLEL POHTS, CLOCK/
CALENDAR AND GAME ADAPTOR ■ RUNS COLOR
GRAPHICS ON A MONOCHROME MONITOR.
■ MOTHERBOARD ■ 256K RAM MEMORY ■ 135 WATT
POWER SUPPLY ■ FLIP-TOP CASE ■ 84 KEY KEYBOARD
■ 366K FLOPPY DRIVE ■ MONOGRAPHICS I/O CARD ■ MONOCHROME MONITOR

## 16 MHz 1 Mb 386

■ MYLEX 386 MOTHERBOARD ■ 1 MB RAM ON BOARD ■ 200 WATT POWER SUPPLY ■ CASE ■ ENHANCED KEYBOARD ■ 1.2 MB FLOPPY DRIVE ■ FLOPPY/HARD CONTROLLER ■ MONOGRAPHICS CARD **■** MONOCHROME MONITOR

#### TI IRRN 4 77/R MHz

■ XT COMPATIBLE ■ NORTON SI 1.7 ■ 4.77 OR 8 MHZ OPERATION WITH 8088-2 AND OPTION-AL 8087-2 CO-PROCESSOR ■ FRONT PANEL LED SPEED INDICATOR AND RESET SWITCH SET SUPPORTED ■ CHOOSE NORMAL/TURBO MODE OR SOFTWARE SELECT PROCESSOR SPEED MCT-TURBO

MCT-XMB STANDARD MOTHERBOARD .....

#### 10 MHz TURBO SINGLE CHIP 8088

■ XT COMPATIBLE ■ NORTON SI 2.1 ■ USES LESS POWER, IMPROVES RELIABILITY ■ KEY SELECTABLE SPEED, 4.77 MHZ OR 10 MHZ ■ 2.3 TIMES FASTER THAN A STANDARD ■ RESET SWITCH, KEYLOCK, AND SPEED / POWER INDICATORS SUPPORTED MCT-TURBO-10

#### 80286 6/10 MHz

\$379.95 ■ AT COMPATIBLE ■ LANDMARK AT SPEED 10 MHZ ■ NORTON SI 10.3 ■ 8 SLOTS (TWO 8-BIT, SIX 16-BIT) ■ HARDWARE SELECTION OF 6 OR 10 MHZ ■ FRONT PANEL LED INDICATOR ■ SOCKETS FOR 1MB OF RAM AND 80287 ■ ONE WAIT STATE ■ BATTERY BACKED CLOCK KEYLOCK SUPPORTED RESET SWITCH

#### 12 MHz MINI- 286

\$399.95 AT COMPATIBLE # LANDMARK AT SPEED 13.2 MHZ NORTON SI 11.6 6 6 MHZ, 10 MHZ (0/1 WAIT STATE), 12 MHZ (1 WAIT STATE), # ZYMOS ASICS FOR FEWER CHIPS, GREATER RELIABILITY # SUPPORTS 512K-1024K MEMORY # RECHARGEABLE HIGH CAPACITY NI-CAD BATTERY # SIX 16-BIT SLOTS, TWO 8-BIT SLOTS # MOUNTS IN STANDARD XT CASE

MCT-M286 6 /10 MHZ MINI 80286 BOARD

\$1699.00 ■ 1 MB RAM ON BOARD ■ 8 SLOTS (TWO 8-BIT, SIX 16-BIT) ■ USES AMI BIOS ■ SUPPORTS 80287 MATH CO.PDOCSSOOD ■ 0.1000 HB USES AMI BIOS SUPPORTS 80287 MATH CO-PROCESSOR SUPPORTS 80387 WITH ADAPTOR 64KB CACHE FOR NEAR Ø WAIT STATE 20 MHZ VERSION AVAILABLE

MCT-386MB

MCT-386MB-4 FOUR MB MEMORY INSTALLED ... \$2999.00 ...\$149.00

MCT-386MB-MCB MATH CO-PROCESSOR ADAPTOR BOARD ....

16 MHz MYLEX **MINI 386** \$**1249**00



■ LANDMARK AT SPEED 23.2 MHZ ■ NORTON SI 18.7 ■ 64KB HIGH SPEED DIRECT MAPPED STATIC RAM CACHE ■ 1 MB OR 2 MB MEMORY ON STD. MEMORY BOARD ■ UP TO 8 MB OF 32-BIT MEMORY ON PIGGYBACK MEMORY BOARD, FOR TOTAL OF 10 MB ■ AM BIOS WITH 32 BIT EGA SUPPORT ■ SOCKETED FOR 8036, MATH CO-PROCESSOR ■ ONE 8-BIT, FOUR 16-BIT AND ONE 32-BIT SLOTS ■ DALLAS CMOS /CLOCK DEVICE ON BOARD W/ BATT. MCT-386 JR (MEMORY CARD REQUIRED)

MCT-386JR20 20 MHZ VERSION ... \$1695.00 MCT-386JR-M 1 TO 2 MB MEMORY CARD (REQUIRED) OF INSTALLED ......\$159.00 MCT-386JR-M8 8 MB PIGGYBACK MEMORY BOARD ØK INSTALLED ..

#### THE IDEAL SYSTEM FOR DEVELOPERS. ALL MODULES USE A COMMON HOST ADAPTOR CARD

#### HOST ADAPTOR CARD

\$29.95

■ A UNIVERSAL INTERFACE FOR ALL THE PROGRAMMING MODULES ■ USER SELECTABLE PROGRAMMABLE ADDRESSES PREVENT ADDRESSING CONFLICTS ■ MENU-DRIVEN SOFTWARE PACKAGE ■ INCLUDES MOLDED CABLE MCT-MAC

#### UNIVERSAL MODULE

5499.99

■ PROGRAMS EPROMS, EEPROMS, PALS, BI-POLAR PROMS 8748 & 8751 SERIES DEVICES ■ TESTS TTL, CMOS, DYNAMIC & STATIC RAMS MCT-MUP

#### DIGITAL IC MODULE

5129.95

■ TESTS TTL, CMOS, DYN. & STATIC RAM ■ AUTO SEARCH



#### **EPROM MODULE**

\$119.95

■ PROGRAMS 24-32 PIN EPROMS, CMOS EPROMS AND EEPROMS FROM 16K TO 1024K

MCT-MEP

MCT-MEP-4 FOUR-EPROM PROGRAMMER ......\$169.95 MCT-MEP-8 EIGHT-EPROM PROGRAMMER .......\$259.95

#### PAL MODULE

\$249.95

PROGRAMS MMI, NS, TI 20 & TI 24 PIN DEVICES

#### 8748 MODULE

\$179.95

PROG. 8741, 8742, 8748, 8749 & 8750 EPROMS & PROMS.

#### **BI-POLAR MODULE**

\$259.95

**MasterCare** 

PROG. AMD, MMI, NS, TI & SIGNETICS BI-POLAR PROMS MCT-MBP

## Microdevices ®

LOCAL (408) 866-6200 FAX (408) 378-8927 TELEX 171-110



VISA

### E & OO - 53

CONTINENTAL U.S. AND CANADA



#### Circle 43 on Reader Service Card



#### Circle 28 on Reader Service Card

1502K Boyce Memorial Drive • PO Box 1040 • Ottawa II 61350

Phone: 815-434-0846



UNIVERSAL LOGIC PROGRAMMER

PROGRAMS, READS, DUPLI-CATES, TESTS AND SECURES LOGIC PROGRAMMER HUNDREDS OF 20- AND 24-PIN DEVICES 23 UNIVER-SAL PIN DRIVERS WITH INDE-BP MICROSYSTEMS PENDENT DAC, ADC & SLEW FUNC

TIONS PROGRAM ALMOST ANY LOGIC DEVICE
MENU DRIVEN OPERATION IS EASY TO LEARN AND QUICK TO OPERATE

TO OPERATE

CONNECTS TO ANY IBM COMPATIBLE COMPUTER VIA
PARALLEL PRINTER PORT

EDITS FUSE DATA & TEST VECTORS WITH FULL

SCREEN EDITOR

SUPPORTS ALL POPULAR PLD DEVELOPEMENT SOFTWARE

GOLD TEXTOOL SIF IC SOCKET

MONIEY BACK GUARANTEE

TOLL-FREE TECH SUPPORT

OPERATOR OF THE PROGRAMMENS

OF THE PROMOTORY OF THE PROMOTORY

EPROM PROGRAMMERS ALSO

SAME DAY SHIPMENT

JUST STAR

CALL FOR FREE DEMO DISK 800/225-2102

**BP**MICROSYSTEMS

10681 HADDINGTON #190 HOUSTON, TX 77043 713/461-9430 TLX: 1561477 FAX: 713/461-7413

#### Circle 43 on Reader Service Card



#### Circle 62 on Reader Service Card



Circle 132 on Reader Service Card



Circle 72 on Reader Service Card

Prices may be subject to change without notice



DATA DIRECT Prices may be subject to change without notice

Circle 73 on Reader Service Card



Leader in High Performance Modems

#### EDITORIAL INDEX BY COMPANY

Index of companies covered in articles, columns, or news stories in this issue
Each reference is to the first page of the article or section in which the company name appears

INQU	JIRY # COMPAN	Y PAGE	INQU	IRY#	COMPANY	PAGE	INQU	JIRY #	COMPANY	PAGE
751	ABSOFT	67	889	CALTEX	SOFTWARE	215	955	FISHER I	NTERNATIONA	AL
801	ACIUS			<b>CAP INT</b>	TERNATIONAL	11		SYSTE	MS	129
	ADDISON-WESLEY			CARNE	GIE-MELLON			FORRES'	TER RESEARCH	H11
852	ADOBE SYSTEMS			UNIVI	ERSITY	11	903	FORTRO	N	164
810	ADVANCE MICRO RES		769	CENTUR	RY SOFTWARE	67	004	CATENIA	*Z 2000	1.0
884	AMSTRAD		900	CLUB AT	Γ	164	904		Y 2000	
782	APOLLO COMPUTER						905		TEMS	
853	APPLE COMPUTER				ADD		754	GREENL	EAF SOFTWAR	.E 67
753	APPLIED LOGIC SYST			COMPU	TER SCIENCE PRI	ESS 50		HARVAR	D UNIVERSITY	PRESS50
800	AST RESEARCH		790	COMTE	RM	67	906	HERTZ C	OMPUTER	164
789	AT&T DATA SYSTEMS		896	DATACO	PY	104	939	HEWLET	T-PACKARD	101
==0	AT&T/SUN				RLD			HITACHI	AMERICA	11
758	AUTODESK	67			OMPUTER			HUGHES	RESEARCH	
898	BLACKSHIP TRADING	164			Y TECHNOLOGIE			LABOR	RATORIES	11
888	BORLAND						796	TDM		67 157
891	INTERNATIONAL	. 101, 119, 151,			DEVELOPMENT		777		MULATIONS	
934		209, 223	885	EPSON A	AMERICA	185	752		IX SOFTWARE.	
941		The second second	785	FACE TE	CHNOLOGIES	67	784			
899	BUS COMPUTER SYST	EMS164					,04		,	

#### COMING UP IN BYTE

#### PRODUCTS IN PERSPECTIVE:

As we go to press for October, here is the tentative lineup of articles on tap for November. While last-minute changes or delays can always occur, the following are those pieces we plan to bring to you.

In the **front of the book**, as usual, will be the Microbytes, Nanobytes, and What's New sections, along with Short Takes—next month on new laptops, languages, utilities, applications, and peripherals. On top of everything else, we'll have our columns: Jerry Pournelle's Computing at Chaos Manor, Ezra Shapiro's Applications Plus, Wayne Rash Jr. and Down to Business, Don Crabb's Macinations, Brock N. Meeks with COM1:, and Mark Minasi's OS/2 Notebook.

The **Product Focus** for November will be project management software. These programs are designed to assist you in keeping track of multiple jobs, schedules, tasks—whatever. How well do they work, and how easy are they to work with? Can something be a help to you if it can't be integrated into the way you do your job? If you've ever wondered if these programs could make your life easier but balked at the price tag, our November Product Focus might be just what you need to help you make up your mind.

System reviews for November include Compaq's new 386s and ALR's new 386 FlexCache machine.

We'll have a hardware review on Transputer boards for both IBM PC-compatible and Macintosh computers.

In the software department, our **software reviews** will look at Zortech's C++ and Gimpel Software's PC-Lint.

For application reviews, we'll take a look at a hard disk drive utility program from Gibson Research called SpinRite, Ashton-Tate's FullWrite Professional 1.0 word processor, and a new communications program from Crosstalk Communications called Remote<sup>2</sup>.

#### IN DEPTH:

Our In-Depth section will focus on parallel processing. We've lined up articles on an entire range of related topics-all intended to work together to provide a comprehensive look at an area that has so far been endowed with more potential than anything else. Where is parallel processing now? Is it always going to be one of those areas that look so good from a distance but up close just seem to dissolve? In November, you'll have a chance to answer these questions for yourself. Not only will we have pieces on new parallel processing chips, but also on programming languages specially designed to take advantage of parallel processing technology. Things may be starting to take on a definite shape.

#### **FEATURES:**

We'll have articles detailing a new chip, **Rekursiv**; a method for performing **multiple regression** analysis with Excel; Part 2 of a piece on **PC power**, this time on backup; Ciarcia's Circuit Cellar covers the second part of his project on a supercomputer; in **Some Assembly Required**, David Betz talks about a new extendable, embedded language.

INQU	JIRY #	COMPANY	PAGE	INQU	IRY#	COMPANY	PAGE	INQU	IRY #	COMPANY	PAGE
761 956 938 795 764	KINETIC LASCAUX LASERGO MANZAN	MS SOFTWARE K GRAPHICS O NA MICROSYSTEM	129 101 230 IS67	783 897 909 770	FOUNI NEC INF SYSTE NEW IM. NEW PC NOVELL	AL SCIENCE DATION ORMATION MS AGE TECHNOLOG NETWORK	67, 230 FY194 164 67	912 794 788 767	AUTON STANFO SUNTRO SYMPHO SYSGEN TAXCAL	NUFACTURING MATIONRD UNIVERSITY NICS DNY SYSTEMS	11 64 67 67
771 907 908	MARTIN LABOR MATHSO MCGRAW MERIDIA MICRO E MICRO I MICROEL	MARIETTA RATORY OFT V-HILL BOOKS AN TECHNOLOGY EXPRESS LECTRONICS AND UTER TECHNOLOGOFT 67	1128367164164237	910 793 763 765 855	OPEN SO FOUNI OXFORD PACESET PACIFIC PALISAD PETROC POLARIS	SYSTEMS  PTWARE DATION  COMPUTER  DATA PRODUCTS  ELLI BOOKS  S SOFTWARE	11 164 67 67 50	935 893 851 760 913	THE WHETHUNDS TOSHIBATUTSIM UNIQ THUNIVER AT BE	NSTRUMENTS IITEWATER GROUERWARE A AMERICA PRODUCTS ECHNOLOGY SITY OF CALIFORKELEY	JP101 194 89 67 164 RNIA11 NG164
942 937 895 854 957 757	MICROTE MIT PRE MULTISO NATIONA SECUR	PEEDEK LABSSSOFTSAL COMPUTER RITY CENTERAL INSTRUMENTS	194 50 89	936 791 811 940 786 911 798	RACORE PRODU RAPID S SALINOI SOUTHV SYSTE SPEAR T SPECTR.	ITY TECHNOLOG COMPUTER JCTS YSTEMS N WORTH MUSIC MS ECHNOLOGY AL INNOVATIONS RD INSTITUTE	67 101 67	915 894 781 772 916 802 778 776 917 857	WARP 9 WELLS WHITE WHOLE WOLFR WORLD Z-SOFT ZEOS IN	DMPUTERS ENGINEERING AMERICAN CRANE SYSTEMS EARTH ELECTRO AM RESEARCH SOFTWARE ITERNATIONAL	

## Computers For The Blind

Talking computers give blind and visually impaired people access to electronic information. The question is how and how much?

The answers can be found in "The Second Beginner's Guide to Personal Computers for the Blind and Visually Impaired" published by the National Braille Press. This comprehensive book contains a Buyer's Guide to talking microcomputers and large print display processors. More importantly it includes reviews, written by blind users, of software that works with speech.

This invaluable resource book offers details on training programs in computer applications for the blind, and other useful information on how to buy and use special equipment.

Send orders to:

National Braille Press Inc. 88 St. Stephen Street Boston, MA 02115 (617) 266-6160

\$12.95 for braille or cassette, \$14.95 for print. (\$3 extra for UPS shipping)

NBP is a nonprofit braille printing and publishing house.

To get further information on the products advertised in BYTE, fill out the reader service card by circling the numbers on the card that correspond to the inquiry number listed with the advertiser. This index is provided as an additional service by the publisher, who assumes no liability for errors or omissions.

\* Correspond directly with company

## Alphabetical Index to Advertisers

Inqu	uiry No. Page No.	Inqui	ry No. Page No.	Inqu	ılry No.	Page No.	Inqu	iry No.	Page No.
	1ST CLASS EXPERT SYSTEMS 106	70	COVOX	151	MANNESMANI	N TALLY 145	221	QUARTERDEC	K 138
4	3RD WAVE	71	CYBER RESEARCH 326	152	MANX SOFTW	ARE SYSTEMS . 125	222	QUARTERDEC	K 138
5	6 A + L MEIER VOGT		DATA DIRECT	153	MAP INFO SYS	STEMS 18			
	ABRA CADABRA SOFTWARE 98		DATA CODE			69			54
	ACCEL TECH326		DATACODE	290			225		
	ACCU-SYS		DB FAST			CEC	226		
9	ADOBE 108,109		DELL COMP. (INT'L) 160,161			NRI 241			H326
	ADVANCED COMP. PROD. 330,331		DELL COMP. (N. AMER.) . 160-163	155	MEAD COMPU	TER319			VICES 317
	AETECH		DIGITALK 36,37	156	MEGA DRIVE	15	230	ROSE ELECTR	ONICS 317
	AETECH		DIGITALK 36,37			15	231	ROSE ELECTR	ONICS 317
	ALPHA PRODUCTS CO 323		DISC INTERNATIONAL 328 DISKCOTECH			320			317
	ALTEX ELECTRONICS 316		DISKETTE CONNECTION 317						
	AMERICAN POWER CONV 24		DISKS TO GO			LEC. PROD.) 312			P. CENTER 337
	AMERICAN RESEARCH CORP 95		DIVERSIFIED COMP. SYS 322			IPUTER PROD 94	236		GINEERING 115
	AMERICAN RESEARCH CORP 95		ECOSOFT 34			HEN INT'L 113			OMPUTER 257
	AMERICAN SEMICONDUCTOR 324		ELEXOR 326	286	METRABYTE.	320			265
20	AMER. SMALL BUS. COMP 131 AMPRO 199		ELLIS114			JTER SQUARE . 266			YSTEMS 144B
21	ANNABOOKS322		EXEREX 26,27 EXEREX 26,27			JTER SQUARE . 266			YSTEMS 144B
	ANAHEIM AUTOMATION 324		E-TECH			SS			OGIES 318 ONICS 264
	ATI TECHNOLOGIES 155		FIVESTAR COMPUTERS . 192,193						
24	ATI TECHNOLOGIES 259	95	FLAGSTAFF ENGINEERING 100			175			VELOP. SYS 91
	ATRON 66	96	FLAGSTAFF ENGINEERING 100		MICROPROCE	SSORS UNLTD. 320	244		CURITY INC 31
	AUTODESK		FOX SOFTWARE23		MICROSOFT	146,147	245	SOLUTION SYS	STEMS 105
	AVOCET SYSTEMS 214 B & B ELECTRONICS		FTG DATA			206,207			
	B & C MICRO		FUJITSU AMERICA 236 FUJITSU AMERICA 236	170		299			118
	B & C MICRO		GATEWAY 2000	170					HICS25
	BAY TECHNICAL ASSOCIATES . 32		GENERAL PARAMETRICS 123	171		NOLOGIES 135			
	BEST COMPUTER 246		GENICOM 8,9			221			60
33	BEST COMPUTER 246		GOLDEN BOW 314			221			
:	BEST WESTERN 46		GRAFPOINT 326			218,219	252	SYSTAT	208
	BINARY TECH		GW INSTRUMENTS 40			218,219			208
	BLAISE		HAMMERLY COMPUTER SERV. 79 HARD DRIVES INT'L 184			E			178
	BOFFIN LTD		HARD DRIVES INT'L 184			GRANT 121			1318
	BORLANDCII		HAYES MICRO PRODUCTS 269						ECHNOLOGIES . 45 ECHNOLOGIES . 45
38	BORLAND CII		HEWLETT-PACKARD 225			TRUMENTS 132	292	TANDON	148,149
	BORLAND 1	112	HEWLETT-PACKARD 227			TRUMENTS 132	293	TANDON	148,149
	BORLAND		HITECH EQUIP CORP 324			TEMS CIII			229
	BORLAND		HOLMES MICROSYSTEMS 30			TEMS 176			231
	BORLAND		HOLMES MICROSYSTEMS 30 HORSTMANN SOFTWARE 116			LECTRONICS 322			NG RESOURCES107
43	BP MICROSYSTEMS 337	117	C EXPRESS		NEW MICROS.				NG RESOURCES117
•	BUYERS MART 300-309		EEE			SYSTEMS 212			42,43
•	BYTE BACK ISSUE 277		NDUSTRIAL AUTOMATION 328				265	TIMELINE	
•	BYTE BACK ISSUE 344		NNOVENTIONS 322	•	ORACLE		127	TOP GUN SYST	EMS213
	BYTE BACK ISSUE/SALE 252		NTECTRA			64			PUTERS 20,21
	BYTE CIRCULATION 220 BYTE SUB. MESSAGE 98		NTEGRAND			GRAW-HILL 292			YSTEMS144D
	BYTE SUB. SERVICE 92		NTEL			TA			ROSS-ASSBRS. 324
•	BYTE SUB. SERVICE 203		O TECH			/STEMS 96 /STEMS 96			136,137 IPHERALS 182,183
	BYTEK324		O TECH			S93			RP 51
45	CADAM222	124	TRON			HNOLOGY 47			ATIVE SFTW 10
46	CADAM	126	JADE COMPUTER 327	194	PATTON & PATT	ON16			S326
47	CALIFORNIA DIGITAL 329		JAMECO			191			DATA 103
	CALIFORNIA SOFTWARE 322 CALIFORNIA SOFTWARE 322		JASON ENTERPRISE 314						CAN
	CAPITAL EQUIPMENT 122		JENSEN & PARTNERS 85 J.D.R. MICRODEVICES 345-360						TWARE 314
	CITIZEN AMERICA 189		J.D.R. MICRODEVICES 332,333						HEIS
•	CLEO SOFTWARE 200		J.D.R. MICRODEVICES 334-336			73			5
	CLUB AMERICAN TECH 82,83		KADAK PROD	201	PERSONAL SPA	ACE COMM 322			ND 314
	CNS, INC		KEA SYSTEMS			296			318
	COEFFICIENT SYSTEMS CO 245		KEA SYSTEMS			SKETTE 298			
	COGITATE298		KNOWLEDGE GARDEN 263			RAPHIC SYS 61			YSTEMS 205 0 48,49
	COGITATE317		AHEY122			LE LOGIC 326			
	COMPACT DISK PRODUCTS 94		ASER CONNECTION 17			S SHOP 105			320
	COMPUCOM		ASER CONNECTION 19	208	PROGRAMMER	'S CONNECTION 39			320
	COMPUSAVE 215		AWSON LABS			S PARADISE 62,63			
61	COMPUSAVE		LINK COMPUTER GRAPHICS . 322 LOGICAL DEVICES 328			HNOLOGY 41	INITE	DNATIONAL CE	TION COICE TO
	COMPUTER AGE		OGICAL DEVICES			312		RNATIONAL SEC orth American Inc	
	COMPUTER BOOK CLUB, THE . 97		OGICAL DEVICES				NONC	an American IIIC	јинов рівавы.
•	COMPUTER CONTINUUM 318	145 L	OGICAL DEVICES 328				311	ABC COMPUTE	R COMPANY . IS-49
	COMPUTER MAIL ORDER 56,57	146 L	OGITECH 74,75		QUAID SOFTWA	RE 58	312	ACER MULTITE	CH IS-28,29
	COMPUTER SURPLUS STORE 320		OGITECH 74,75			318			INGIS-38
	COMPUTERLANE UNLTD 177 CONTECH		OGITECH 87 OGITECH 87			156			VLEDGE SYS. IS-10 NGINES IS-34
	CONTROL VISION 312		MANNESMANN TALLY 145			( 128			
	The latest the second s						Real C		
340	BYTE • OCTOBER 1988								

Advertising Supplement included with this issue: JDR Microdevices (U.S. and Canada Subscribers)

\* Correspond directly with company.

Page No. Inquiry No.

Inquiry No.	Page No.
Inquiry No.  317 BIX. 318 BLUE CHIP TECHNOLOG 344 BYTE BITS  BYTE SUB. MESSAGE  BYTE SUB. MESSAGE  BYTE SUB. SERVICE  319 CALEND  320 CLARION  321 COMPUADD  322 COMPUTER ELEC. INFO 359 CONTROL TELEMETRY 323 CUBIX  324 DATEX  325 ELEKTRONIC EQUIP. CO 326 ELONEX  327 EQUIPU A.I.R. LTD. 328 FACIT AB  329 FLEMMING SOFTWARE 330 FORMOSA 331 GAMMA PRODUCTIONS 332 GREY MATTER 333 GSE  334 GTCO 335 HARRISON PRECISION 336 INES 337 IRIS 338 INTERLOG SOFTWARE 339 ISE DATA 340 KESSLER 341 LASER TEAM  MCGRAW-HILL BOOKS 342 MICRO TECHNOLOGY	IS-45 IY IS-38 IS-32 IS-44 IS-26 IS-42 IS-33 IS-41 IS-21 IS-41 IS-25 IS-15 IS-39 IS-11 IS-23 IS-12.13 IS-34 IS-47 IS-36 IS-36 IS-36 IS-37 IS-22 IS-38 IS-38 IS-24 IS-38 IS-24 IS-38 IS-24 IS-38 IS-22 IS-55
343 MICROPHAR 345 NEOLEC 346 NOVELL DEVELOPMEN	IS-40

Inqui	ry No.	Page No.
347 348 349 350 352 353 354 355 356 357 358		IS-9 IS-32 ECT. IS-25 TION IS-19 IS-27 IS-27 IS-20 IS-36 IS-36
REGI	ONAL SECTIONS	
Mid-	Atlantic	88 M/AT 1-8
476 477 478 479 480 481 482 483	D-DATA	RS 88M/AT-7 RS 88M/AT-7 88M/AT-6 88M/AT-4 88M/AT-1 RV. 88M/AT-5
Midv	vest	88 MW 1-8
487 488		88MW-4 88MW-8 ERS . 88MW-3

	ROBT. TINNEY GRAF SPEAR TECHNOLOG Y.E.S. MULTINATION	PHICS88MW-6 Y 88MW-1
Norti	neast	88 NE 1-16
510 511 512 513 514 516 517 518 519 520	COMPARE COMPUT COMPARE COMPUT COMPUTER RES. CT CORTEX CORP. DRESSELHAUS COMF E.R.M. ASSOC. INTERFACE GROUP MICROCOMP.MKTG.C MICROSMART PC LINK.	
Paci	fic Coast	88 PC 1-12
526 527 528 529 530 531	ALTEC TECHNOLOG B & B ELECTRONICS COMPUTOWN KMS	88PC-4 88PC-2 88PC-9 88PC-11

MICROCOMP MKTG COUN. 88MW-5

532 533 534 535 536 537 538	MS ENGINI NEURALW/ NU-MEGA ROBT. TINI SF MICRO SURAH	EERING, INC. EERING, INC. ARE NEY GRAPHIC	88PC-7 88PC-5 88PC-10 CS 88PC-8 88PC-1
Sout	heast	·	88 SE 1-8
495 496	COMP. FO D-DATA KNAPCO . MCGRAW- MICROCON MICROMIN	R THE BLIND  HILL BOOKS  MP.MKTG.COUI  NT  NEY GRAPHI	88SE-4 88SE-8 88SE-1 88SE-5 N 88SE-3 88SE-6
Sout	thwest		88 SW 1-8
500 501 502 503	BYTE TIPS COMP. FO GENERAL KMS. KMS. MCGRAW MICROCOL	JTER CORP.  THE BLIND BUS. MACHIN  HILL BOOKS MP.MKTG.COU	88SW-2 88SW-4 IES 88SW-1 88SW-3 88SW-7 N 88SW-5
* Cc	rrespond di	rectly with com	pany.

Page No.

#### BYTE ADVERTISING SALES STAFF: Dennis J. Riley, Director of Sales, One Phoenix Mill Lane, Peterborough, NH 03458, tel. (603) 924-9281 Jennifer L. Bartel, West Coast Sales Manager, 8111 LBJ Freeway, Suite 1350, Dallas, Tx 75251, tel. (214) 644-1111

MCGRAW-HILL BOOKS . . 88MW-7

NEW ENGLAND ME, NH, VT, MA, RI, ONTARIO CANADA & EASTERN CANADA John C. Moon (617) 262-1160 McGraw-Hill Publications 575 Boylston Street Boston, MA 02116

ATLANTIC NY, NYC, CT, NJ (NORTH) Leah G. Rabinowitz (212) 512-2096 McGraw-Hill Publications 1221 Avenue of the Americas-36th Floor New York, NY 10020

McGraw-Hill Publications Building A—3rd Floor 777 Long Ridge Road Stamford, CT 06902

PA, NJ (SOUTH), MD, VA, W.VA, DE, D.C. (215) 496-3833 McGraw-Hill Publications Three Parkway Philadelphia, PA 19102

SOUTHEAST NC, SC, GA, FL, AL, TN Thomas Tolbert (404) 252-0626 McGraw-Hill Publications 4170 Ashford-Dunwoody Road Suite 420 Atlanta, GA 30319

MIDWEST MIDWES1 IL, MO, KS, IA, ND, SD, MN, KY, OH, WI, NB, IN, MI, MS Bob Denmead (312) 751-3740 McGraw-Hill Publications Blair Building 645 North Michigan Ave. Chicago, IL 60611

SOUTHWEST, ROCKY MOUNTAIN CO, WY, OK, TX, AR, LA Karl Heinrich (713) 462-0757 McGraw-Hill Publications 7600 W. Tidwell Rd. —Suite 500 Houston, TX 77040

SOUTHERN CA, AL, NM, LAS VEGAS Jack Anderson (714) 557-6292 McGraw-Hill Publications 3001 Red Hill Ave. Building #1—Suite 222 Costa Mesa, CA 92626

Tom Harvey (213) 480-5243 McGraw-Hill Publications 3333 Wilshire Boulevard #407 Los Angeles, CA 90010

NORTH PACIFIC HI, WA, OR, ID, MT, NORTHERN CA, NV (except LAS VEGAS), UT, W. CANADA Mike Kisseberth (415) 362-4600 McGraw-Hill Publications 425 Battery Street San Francisco, CA 94111

Bill McAfee (415) 349-4100 McGraw-Hill Publications 951 Mariner's Island Blvd.-

#### **International Advertising Sales Staff:**

Mr. Hans Csokor Publimedia Reisnerstrasse 61 A-1037 Vienna, Austria 222 75 76 84

Mrs. Gurit Gepner McGraw-Hill Publishing Co. PO Box 2156 Bat Yam, 59121 Israel 3 866 561 321 39

Serving Germany, Austria, & Switzerland McGraw-Hill Publishing Co. 34 Dover St. London W1X 4BR England 01 493 1451

Mrs. Maria Sarmiento Pedro Teixeira 8, Off. 320 Iberia Mart 1 Madrid 4, Spain 1 45 52 891

Michael Karnig Andrew Karnig & Associates Finnbodavagen S-131 31 Nacka, Sweden 8-44 0005

Mr. Alain Faure McGraw-Hill Publishing Co. 128 Faubourg Saint Honore 75008 Paris France (1) 42-89-03-81

SOUTH PACIFIC SOUTHERN CA, AZ, NM,

Inquiry No.

3rd Floor San Mateo, CA 94404

Karen Lennie McGraw-Hill Publishing Co. 34 Dover St. London W1X 4BR England 01 493 1451

Emilio Zerboni McGraw-Hill Publishing Co. Via Flavio Baracchini 1 20123 Milan, Italy (2) 89010103

BYTE BITS (2x3)
Dan Harper (603) 924-6830
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

The Buyer's Mart (1x2) Mark Stone (603) 924-3754 **BYTE Publications** One Phoenix Mill Lane Peterborough, NH 03458

Regional Advertising (So. CA, Mid-Atlantic, New York/New England) Elisa Lister (603) 924-6830 BYTE Publications One Phoenix Mill Lane Peterborough, NH 03458

(Southeast, Southwest Denise Vernier (603) 924-9281
BYTE Publications
One Phoenix Mill Lane Peterborough, NH 03458

Liz Coyman (603) 924-9281 BYTE Publications One Phoenix Mill Lane Peterborough, NH 03458

Seavex Ltd. Seavex Ltd.
400 Orchard Road, #10-01
Singapore 0923
Republic of Singapore
Tel: 734-9790
Telex: RS35539 SEAVEX

Seavex Ltd. 503 Wilson House 19-27 Wyndham St. Central, Hong Kong Tel: 5-260149 Telex: 60904 SEVEX HX Regional Advertising (Pacific NW, Midwest, New York/New England) Scott Gagnon (603) 924-6830 BYTE Publications One Phoenix Mill Lane Peterborough, NH 03458

**BYTE Deck Mailings** National Ed Ware (603) 924-6166 BYTE Publications One Phoenix Mill Lane Peterborough, NH 03458

A/E/C Computing Deck Computing for Engineers Mary Ann Goulding (603) 924-9281 BYTE Publications
One Phoenix Mill Lane Peterborough, NH 03458

Hiro Morita McGraw-Hill Publishing Co. Overseas Corp. Room 1528 Room 1528 Kasumigaseki Bldg. 3-2-5 Kasumigaseki, Chiyoda-Ku Tokyo 100, Japan 3 581 9811

Mr. Ernest McCrary Empresa Internacional de Comunicacoes Ltda. Rua da Consolacao, 222 Conjunto 103 01302 Sao Paulo, S.P., Brasil Tel: (11) 259-3811 Telex: (100) 32122 EMBN

To get further information on the products advertised in BYTE, fill out the reader service card by circling the numbers on the card that correspond to the inquiry number listed with the advertiser. This index is provided as an additional service by the publisher, who assumes no liability for errors or omissions.

Inquiry No.

Page No.

\* Correspond directly with company

## Index to Advertisers by Product Category

Inqu	iry No.	Page No.
	HARDWA	ARE
360		ADD INS
14 23 29 318 49	ATI TECHNOLOGIE B & C MICRO	S 155 314 298 OLOGY 88IS-38 NT 122
69 330 334 336 120 122 123 140 170	CONTROL VISION FORMOSA GTCO INES INTEL IO TECH LAWSON LABS MICROWAY MICROWAY NOHAU CORP PERISCOPE PERSONAL SPACE QUA TECH QUA TECH QUA TECH QUA TECH	
361 156 157 299 300 251 292 293	MEGA DRIVE MEGA DRIVE PACIFIC RIM SYSTE PACIFIC RIM SYSTE SYSGEN TANDON TANDON	EMS 96 EMS 96
362		ROGRAMMERS
43 44 141 144 145 183 206 279	B & C MICRO.  BP MICROSYSTEM BP MICROSYSTEM BYTEK.  LINK COMPUTER G LOGICAL DEVICES NEEDHAM'S ELECT PROGRAMMABLE I XELTEK XENDER	S
363	INST	RUMENTATION
286	GW INSTRUMENTS INDUSTRIAL AUTOI INNOVENTIONS	
364	KEY	BOARDS/MICE
	HARRISON PRECIS LOGITECH	

Inqu	ulry No. Page No.
147 247	LOGITECH 74,75 SUMMAGRAPHICS25
365	MASS STORAGE
13 156 157 190 217 257 258 270	MAXELL         7           MEGA DRIVE         15           MEGA DRIVE         15           OVERLAND DATA         312           QUALSTAR         318           TALLGRASS TECHNOLOGIES         45           TALLGRASS TECHNOLOGIES         45
•	MISCELLANEOUS
22 31 59 62 70 119 132 142 143 162 271	ANAHEIM AUTOMATION 324 BAY TECHNICAL ASSOCIATES 32 COMPUQUEST 298 COMPUTER AGE 337 COVOX 124 INTECTRA 314 INTEGRAND 143 KADAK PROD 337 LOGICAL DEVICES 328 LOGICAL DEVICES 328 MERRITT COMPUTER PROD 94 VIZIFLEX SEELS 326
366	MODEMS/MULTIPLEXORS
	COMPUCOM
367	MONITORS
174 175 204 298 260 281	MITSUBISHI       218,219         MITSUBISHI       218,219         PRINCETON GRAPHIC SYS       61         SHARP       265         TATUNG       231         ZENITH DATA SYSTEMS       205
368	NETWORK HARDWARE
516 124	BAY TECHNICAL ASSOCIATES . 32 COGITATE
369	POWER SUPPLIES
345	AMER. POWER CONVERSION . 24 NEOLEC
370	PRINTERS/PLOTTERS
53 517	BAY TECHNICAL ASSOCIATES . 32         CITIZEN AMERICA

Inqu	ilry No. Page No.
328 102 104 111 112 150 151 230 231 269 283	FUJITSU AMERICA 236 GENICOM 8,9 HEWLETT-PACKARD 225 HEWLETT-PACKARD 145 MANNESMANN TALLY 145 MANNESMANN TALLY 145 NEC INFO SYSTEMS CIII ROSE ELECTRONICS 317 VENTURA PERIPHERALS 182,183
371	PRINTER RIBBONS
•	BEST WESTERN 46
372	SCANNERS/DIGITIZERS
337 148 149 171 172	FLAGSTAFF ENGINEERING 100 IRIS 88IS-16 LOGITECH 87 MIRROR TECHNOLOGIES 135
373	SOFTWARE SECURITY
359 343 226	ALADDIN KNOWLEDGE SYS 88IS-10 CONTROL TELEMETRY . 88IS-42 MICROPHAR
374	SYSTEMS
311 291 312 527 17 18 19 32 33 51 479 514 79 80 325 326 92 92 92 93 39 160 165 166 168 532 533 347 482 533 347 482 533 533 547 548 549 549 549 549 549 549 549 549 549 549	ACCU-SYS

	,
483 536 490 521 248 259 522 358 273 276 282	SPEAR TECHNOLOGY         88MW-1           SPEAR TECHNOLOGY         88NE-4           SUNTRONICS         112           TATUNG         229           TOSHIBA COMPUTERS         20,21           UNIQ TECH         88NE-10           WAVE MATE INC         88IS-17           WELLS AMERICAN         13           WINTEK         314
	SOFTWARE
375	APPLE2/MAC APPLICATIONS —Business/Office
97	FOX SOFTWARE23
376	IBM/MSDOS APPLICATIONS —Business/Office
4 7 320 56 98 331 105 346 348 193 194 221 222 223 261 262	ABRA CADABRA SOFTWARE . 98 CLARION . 88IS-43 COGITATE
89 329 116 154 181 182 481 534 288 246 252	DAYTRON ELECTRONICS 324 ECOSOFT 34 FLEMMING SOFTWARE 88IS-34 HORSTMANN SOFTWARE 116 MATHSOFT 69 NATIONAL INSTRUMENTS 132 NATIONAL INSTRUMENTS 132 NATIONAL INSTRUMENTS 132 NEURALWARE 88M/AT-1 NEURALWARE 88M/AT-1 NEURALWARE 88PC-5 SPECTRUM 243 SYSTATSOFT 118 SYSTAT 208 SYSTAT 208 IBM/MSDOS APPLICATIONS —Miscellaneous

153 MAP INFO SYSTEMS . . . . . . . . 18

Advertising Supplement included with this issue: JDR Microdevices (U.S. and Canada Subscribers)

\* Correspond directly with company.

inqui	ry No. Page No.	Inquiry No.	Page No.	Inquiry No.	Page No.	Inquiry No.	Page No.
379	IBM/MSDOS—CAD	383	IBM/MSDOS COMMUNICATIONS				MARKETING
R	ACCEL TECH326		COMMUNICATIONS		88SW-3		SUB. MESSAGE 88IS-26
_	AMER. SMALL BUSINESS COMP 131	54 COEFFICII	ENT SYSTEMS CO 245	503 KMS			SUB. SERVICE 92
	AUTODESK 150		ED COMP. SYS 322		88SE-1	* BYTES	SUB. SERVICE 203
	CADAM 222	106 GRAFPOIN	IT 326	* MCGRAW-HILI	BOOKS 88IS-51		SUB. SERVICE 88IS-42
	CADAM 222	133 KEA SYST	EMS 46	* MCGRAW-HILI	BOOKS 88MW-7		TIPS 88MW-4
277	WINTEK CORP 5		EMS 314	<ul> <li>MCGRAW-HILI</li> </ul>	BOOKS 88SE-5		TIPS
			5 322		BOOKS 88SW-7		TIPS 88SW-2
380	IBM/MSDOS-LAN				TER319		UTER BOOK CLUB, THE . 97
	I DIII/III D G G I I I I	243 SUFTHUN	105		320		S. FOR THE BLIND 88SE-4 S. FOR THE BLIND 88SW-4
41	BORLAND	384	OTHER-LANGUAGES		LECT. PROD.) . 312		RESEARCH 326
	BORLAND	-			22		IGENCEWARE99
	DATEX 88IS-39	327 EQUIPU A	I.R. LTD 88IS-23		TG.COUNCIL 88MW-5		FACE GROUP 88NE-13
	SIMPLE NET SYSTEMS 144B	285 Z-WORLD	320		TG.COUNCIL 88NE-12		ENTERPRISE 314
	SIMPLE NET SYSTEMS 144B				TG.COUNCIL 88PC-6		LEDGE GARDEN 263
355	TRAFFIC SOFTWARE 88IS-36	385 OTHER-	CROSS DEVELOPMENT		TG.COUNCIL .88SE-3		AW-HILL CEC 273
					CTG.COUNCIL 88SW-5	* MCGR	AW-HILL NRI 241
381	IBM/MSDOS-LANGUAGES		E DEV. SYS 91		88SE-6	295 MESSI	E MUNCHEN INT'L 113
	IDIII/IIIODOG—EAITGOAGES	267 UNIV. CRO	SS-ASSEMBLERS . 324		SSORS UNLTD. 320		RNE MCGRAW-HILL 292
5	A + L MEIER VOGT 251			And the same of th	55		
	AETECH				Y GRANT 121		
12	AETECH 280	Service and the service		179 M.H.I	313		
315	ANALYTICAL ENGINES 88IS-34	386	MAIL ORDER/	186 OMEGA MICR	O SYSTEMS 212	200	DECKTOR
	BORLAND CII	-	RETAIL		88NE-5	388	DESKTOP
38	BORLAND CII		RETAIL		59		PUBLISHING
	BORLAND 1	500 3D COMPI	JTER CORP 88SW-8		190		
	BÖRLAND 1		CIATES 88PC-12		ATA 88IS-32		E 108,109
	CALEND 88IS-33		PUTER PRODS. 330,331		ISKETTE 298		CONNECTION 17
	CNS, INC 204		ECTRONICS 316		E 325		CONNECTION 19
	CNS, INC		CTRONICS 337		RS SHOP 105		R TEAM 88IS-22
	DIGITALK 36,37		CTRONICS 88PC-2		CONNECTION 39		DSOFT 206,207 S GMBH 88IS-20
	DIGITALK 36,37	36 BOFFINLT	D127		R'S PARADISE 62,63	354 TOOLS	GUNDH 6613-20
	ELLIS114		MART 300-309		GRAPHICS88MW-6		
	GSE 88IS-37 HAMMERLY COMP. SERVICES 79		IIA DIGITAL 329		GRAPHICS . 88NE-14 GRAPHICS 88PC-8		
	JENSEN & PARTNERS 85	487 CAMBRID	GE DIRECT 88MW-8		GRAPHICS 88SE-7	-	
	LAHEY122	476 CAMBRID	GE DIRECT 88M/AT-8		GRAPHICS 88SW-6	389	RECRUITMENT
	MANX SOFTWARE SYSTEMS . 125	509 CAMBRID	GE DIRECT 88NE-16				
	MICROSOFT 146,147		DATA88NE-1		GINEERING 115	* MICRO	DSOFT CORP 299
170	MICROWAY		DISK PRODUCTS 94		CRO ELECT. 88IS-25		
	MIX SOFTWARE 297		COMPUTERS . 88MW-3	238 SHAMROCK C	OMPUTER 257		
268	USERSOFT 136,137		COMPUTERS . 88MW-3	241 SKAN TEKNO	LOGIES 318		
357	WARREN POINT 88IS-36		COMPUTERS 88M/AT-7	242 SN'W ELECTF	ONICS 264	* M	<b>IISCELLANEOUS</b>
			COMPUTERS 88M/AT-7 COMPUTERS 88NE-6		RPORATION 88IS-19		
382	IBM/MSDOS		COMPUTERS 88NE-6		STEMS 105		A
302	UTILITIES		AVE		88PC-3	313 AL DO	WNLOADING 88IS-38
	UTILITIES		R MAIL ORDER 56,57	the state of the state of the state of	88PC-3	316 BCL .	88IS-34
6	A + L MEIER VOGT 253		R SURPLUS STORE 320		88IS-27		RESOURCE CTR. 88NE-1
	ATRON 66		OWN 88PC-9		88IS-27		NFO SYSTEMS 176
	AVOCET SYSTEMS 214		RLANE UNLTD 177		5 178 42,43		RGET 328
	BLAISE		1 328			233 SAFE	WARE
47	CALIFORNIA S/W PROD 322		ECT 337	Complete the second of the sec			
	CALIFORNIA S/W PROD 322	73 DATA DIRI	ECT 337		RE 88IS-7		
	DATACODE		RNATIONAL 328		DATA 103		
113	HITECH EQUIP. CORP 324		CH 318		& THEIS GMBH . 126	390	<b>OPERATING</b>
	MATRIX	86 DISKETTE	CONNECTION 317		ATIONAL 88MW-2	030	
	MICRO COMPUTER SQUARE . 266		GO 324				SYSTEMS
	MICRO COMPUTER SQUARE . 266		88M/AT-4			105 NEW	MICROS 320
	MIX SOFTWARE 297						TUM
	NU-MEGA 88PC-10		. MACHINES 88SW-1	007 FD	LICATIONIAL /		A CRUZ OPERATION 169
	POLYTRON		TTER 88IS-35		UCATIONAL/	234 SANT	CHOZOFERATION 16
224	QSET		VES INT'L 184	INST	RUCTIONAL		
210			VES INT'L 184				
	QUARTERDECK		SS		322	201	ONLLINE
	SUPERSOFT				88IS-45	391	ON-LINE
	TOP GUN SYSTEMS 213				SUE 344		SERVICES
	VERMONT CREATIVE S/W 10		RODEVICES 332,333		SSUE 277		
	WENHAM SOFTWARE 314		RODEVICES 332,333		SSUE/SALE 252		
214		The second of the second secon		344 BYTE BITS .	88IS-32		PUSERVE 287
272	WOODCHUCKIND 314		RODEVICES 345-360		ATION 220		O TECHNOLOGY 88IS-31

	1985	1986	1987	1988
Jan.	\$4.00			\$6.00
Feb.	\$4.00	\$6.00	\$6.00	
March	\$4.00		\$6.00	\$6.00
April	\$4.00		\$6.00	
May	\$4.00		\$6.00	\$6.00
June	\$4.00	\$6.00	\$6.00	\$6.00
July		\$6.00	\$6.00	\$6.00
Aug.	\$4.00	\$6.00	\$6.00	\$6.00
Sept.	\$4.00	\$6.00	\$6.00	
Oct.	\$4.00			
Nov.	\$4.00			
Dec.	\$4.00	\$6.00		

#### BACK ISSUES FOR SALE

\$2.00
\$2.50
\$2.00
\$2.50
\$4.75
\$5.00
\$4.00

Circle and send requests with payments to:

BYTE Back Issues One Phoenix Mill Lane Peterborough, NH 03458 (603) 924-9281

	(603) 924-9281
☐ Check enclosed Payments from foreign countries must	be made in US funds payable at a US bank.
□ VISA □ MasterCard	
Card #	Exp. Date
Signature	
The above prices include postage in the US. Please add \$ .50 per face delivery). Please allow 4 weeks for domestic delivery and 12 v	copy for Canada and Mexico; and \$2.00 per copy to foreign countries (surveeks for foreign delivery.
European customers please refer to Back Issue order form in Inte	rnational Advertising section of book.
Name	
Address	
Сіту	State Zip

TIPS		SUBSCRIBERS ONLY!* Use BYTE's Telephone Inquiry Processing System Using TIPS can bring product information as much as 10 days earlier.		
SEND FOR YOUR SUBSCRIBER I.D. CAR	1) <b>ED</b>	If you are a new subscriber or have lost your I.D. card, circle #1 on the Reader Service Card; attach mailer label. We will immediately send your personal TIPS subscriber card.		
GET PREPARED 2)		Write your Subscriber Number, as printed on your Subscriber I.D. Card, in boxes in Step 5 below. (Do not add 0's to fill in blank boxes)		
	3)	Write numbers for information desired in boxes in Step 7b below. (Do not add 0's to fill in blank boxes.)		
CALL TIPS	4)	Now, on a Touch-Tone telephone dial: (413) 442-2668 and wait for voice commands.		
ENTER YOUR SUBSCRIBER AND ISSUE NUMBERS	5)	When TIPS says: "Enter Subscriber Number" (Enter by pushing the numbers and symbols [# or * enclosed in the boxes] on telephone pad ignoring blank boxes) Enter \( \\ \\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \		
	6)	When TIPS says "Enter magazine code & issue code" Enter ① 田 ① 図 田 田		
ENTER YOUR INQUIRIES	7a)	When TIPS says "Enter (next) Inquiry Number" Enter one inquiry selection from below (ignore blank boxes)		
	b)	Repeat 7a as needed (maximum 17 inquiry numbers)		
	==	1. □ □ □ □ 田		
END SESSION	8)	End session by entering * * 9 11 # #		
	9)	Hang up after hearing final message If you are a subscriber and need assistance, call (603) 924-9281.		

If you are not a subscriber fill out the subscription card found in this issue or, call BYTE Circulation 800-423-8272.

\*Domestic and Canadian Subscribers Only!

## Information Retrieval Service

To assist you in making your evaluations, purchasing decisions, or recommendations, you can request further information directly from the manufacturer or service company on products and services advertised in this issue. There is no charge, no obligation. Just complete and mail the attached post-paid, self-addressed reply card, and we'll do the rest.



Circle numbers on reply card which correspond to numbers assigned to items of interest to you.



Check all the appropriate answers to questions "A" through "F".



Print your name and address and mail.

Fill out this coupon carefully. PLEASE PRINT. Req	uests cannot be	CIRCLE FOR FREE INFORMATION OCTOBER 48ARS	U
honored unless the zip code is included. This card is from cover date.	valid for 6 months	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 74 76 47 76 77 77 77 78 78 78 78 78 78 78 78 78 78	54
1 □ Business Owner, General Management, Administrative       is received: Leave and the purchas         2 □ MIS/DP, Programming       2 □ Evaluat         3 □ Engineering/Scientific, R&D       3 □ Specific         4 □ Professional (law, medicine, accounting)       E. Please indicategories	se order ion ation/Recommendation icate the product for which you	244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 287 288 289 290 291 292 293 294 295 296 287 288 289 290 291 292 293 294 295 296 287 288 289 290 291 292 293 294 295 296 287 288 289 290 291 292 293 294 295 296 287 288 289 290 291 292 293 294 295 296 287 288 289 290 291 292 293 294 295 296 287 288 289 290 291 292 293 294 295 296 287 288 289 290 291 292 293 294 295 296 287 288 289 290 291 292 293 294 295 296 287 288 289 290 291 292 293 294 295 296 287 288 289 290 291 292 293 294 295 296 287 288 289 290 291 292 293 294 295 296 287 288 289 290 291 292 293 294 295 296 287 288 289 290 291 292 293 294 295 296 288 289 290 291 292 293 294 295 296 288 289 290 291 292 293 294 295 296 288 289 290 291 292 293 294 295 296 288 289 290 291 292 293 294 295 296 288 289 290 291 292 293 294 295 296 288 289 290 291 292 293 294 295 296 288 289 290 291 292 293 294 295 296 288 289 290 291 292 293 294 295 296 288 289 290 291 292 293 294 295 296 288 289 290 291 292 293 294 295 296 288 289 290 291 292 293 294 295 296 295 296 295 296 295 296 295 296 296 296 296 296 296 296 296 296 296	108 135 162 189 216 243 270 297
B. How many people does your company employ?  1	rals	298 299 300 301 302 303 304 305 306 307 308 309 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 325 326 327 328 329 330 331 332 333 344 355 36 37 38 339 340 341 342 343 344 345 346 347 348 349 350 327 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 404 405 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 435 346 437 348 439 440 414 442 443 444 445 446 447 448 449 450 451 452 453 454 454 454 454 464 47 484 449 450 451 452 453 454 454 454 464 47 488 489 490 491 492 493 494 495 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 595 596 597 598 599 599 690 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 602	351 378 405 432 459 486 513 540 567 594
	ompany or organi- 3 □ 5-9 4 □ 10 or more	622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 649 650 651 652 653 654 655 656 657 658 659 650 661 662 663 664 665 666 667 668 669 670 671 672 673 674 670 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 737 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 758 759 760 761 762 763 764 765 766 767 668 769 760 761 762 763 764 765 765 765 765 765 765 765 765 765 765	648 675 702 729 756 783
CompanyAddress		811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 889 860 861 862 863 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 866 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917	864 891
City         State           Zin         Telephone		919 920 921 922 923 924 925 926 927 928 928 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 951 962 963 964 965 966 967 968 969 970 971 971 973 974 975 976 977 978 979 980 981 982 983 984 985 996 987 988 989 990 991 992 993 984 985 996 997 998	



#### **BUSINESS REPLY MAIL**

FIRST CLASS MAIL PERMIT NO. 176 DALTON, MA

POSTAGE WILL BE PAID BY ADDRESSEE



READER SERVICE PO Box 298 Dalton, MA 01227-0298 USA NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

## Information Retrieval Service

To assist you in making your evaluations, purchasing decisions, or recommendations, you can request further information directly from the manufacturer or service company on products and services advertised in this issue. There is no charge, no obligation. Just complete and mail the attached post-paid, self-addressed reply card, and we'll do the rest.



Circle numbers on reply card which correspond to numbers assigned to items of interest to you.



Check all the appropriate answers to questions "A" through "F".



Print your name and address and mail.



37 39

136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152

163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179

190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206

217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233

244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260

271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287

298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314

325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341

352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368

379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395

406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422

460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476

487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503

514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530

541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557

568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584

595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611

622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638

649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665

676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692

703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746

757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798

433 434 435 436 437 438 439 440 441 442 443 444 445 446 447

91 92

118 119

93 94

69

811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837

838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 258 859 860 861 862 863 864

56 57 58 59 60 61 62 63 64 65 66

#### **BUSINESS REPLY MAIL**

FIRST CLASS MAIL PERMIT NO. 176 DALTON, MA

POSTAGE WILL BE PAID BY ADDRESSEE



READER SERVICE PO Box 298 Dalton, MA 01227-0298 USA

NO POSTAGE **NECESSARY** IF MAILED IN THE UNITED STATES

_	_	_						-		_
			C	CT	OE	BEF	48	AR	RSU	
18	19	20	21	22	23	24	25	26	27	
45	46	47	48	49	50	51	52	53	54	
72	73	74	75	76	77	78	79	80	81	
99	100	101	102	103	104	105	106	107	108	
126	127	128	129	130	131	132	133		135	
153	154	155	156	157	158	159		161		
180	181	182	183	184	185	186	187	188	189	
207	208	209	210	211	212	213	214	215	216	
234	235	236	237	238	239	240	241	242	243	
261	262	263	264	265	266	267	268	269	270	
288	289	290	291	292	293	294	295	296	297	
315	316	317	318	319	320	321	322	323	324	
342	343	344	345	346	347	348	349	350	351	
369			372	373	374			377	378	
396	397	398	399	400	401	402	403	404	405	
423	424	425	426	427	428	429	430	431	432	
450	451	452	453	454	455	456	457	458	459	
477	478	479	480	481	482	483	484	485	486	
504	505	506		508	509	510	511	512	513	
531		533	534	535	536		538			
558	559		561		563	564	565	566		
585	586	587	588	589	590	591	592	593	594	
612	613	614	615	616	617	618	619	620	621	
639	640	641	642	643		645	646			
666	667	668	669	670	671	672	673			
693	694		696	697	698	699		701	702	
720	721	722		724		726				
747		749		751	752	753		755	756	
	775	776	777	778	779	780	781	782	783	

Fill out this coupon carefully. PLEAS	E PRIN	T. Req	uests	canno	ot be
honored unless the zip code is include	d. This o	card is	valid	for 6	months
from cover date.					
A. What is your primary job function?	100				

(Check one only) ☐ Business Owner, General

- Management, Administrative ☐ MIS/DP, Programming
- 3 

  Engineering/Scientific, R&D 4 Professional (law, medicine,
- accounting) 5 🗆 Other

B. How many people does your company employ?

- ☐ 25 or fewer 26-99
- □ 100-499 □ 500-999
- □ 1000 or more

C. Reason for request: (Check all that apply).

- ☐ Business use for yourself ☐ Business use for your company
- 3 Personal use

Name

- D. Your next step after information is received:
- ☐ Purchase order □ Evaluation
- 3 

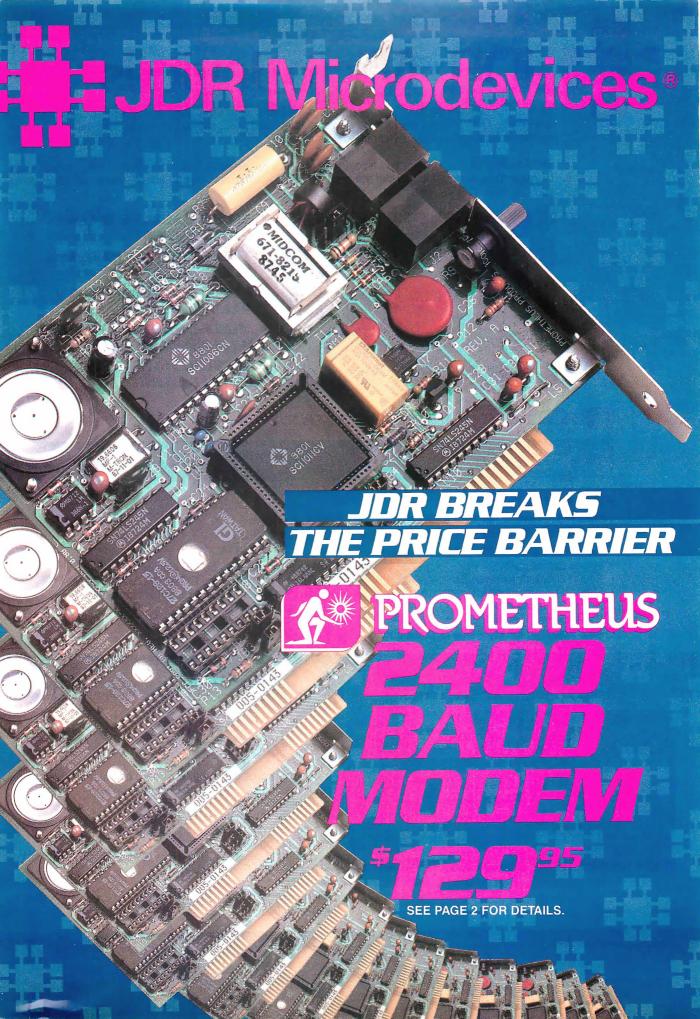
  Specification/Recommendation
- E. Please indicate the product categories for which you influence the selection or purchase at your (or your client's) company or organization. (Check all that apply).
- ☐ Microcomputers ☐ Peripherals
- ☐ Software
- ☐ Accessories and supplies
- F. For how many microcomputers do you influence the purchase of products at your (or your client's) company or organization?
- 3 □ 5-9  $\Box 2-4$ 4 \Box 10 or more

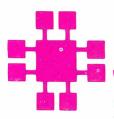
Company Address

Telephone

865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999

82 83 84 85 86 87 88 89 90





## JDR Microdevices®

Here at JDR we are constantly striving to upgrade our products and services in order to better serve our customers. Over the last few months we've added phone lines, sales staff and technical support representatives to improve speed and after-sale support.

This insert is all about upgrading also. In the next few pages you'll find products that will give you more storage, more speed and more of the latest technology at prices you can afford. And remember, when you buy from JDR you're assured of these services:



- 30 DAY MONEY BACK GUARANTEE
- TOLL-FREE TECHNICAL
   SUPPORT
- 1 YEAR WARRANTY ON ALL PRODUCTS
- MOST ORDERS SHIPPED WITHIN 24 HOURS
- NO SURCHARGE FOR CREDIT CARDS





#### FROM OUR COVER:

2400 baud breakthrough! This well designed and solidly built modem offers 2400bps performance at an incredibly low price. For only \$129.95 you get all these great features:

- Hayes compatibility
- 2400/1200/300bps operation
- Mirror II communications software
- Automatic answer/dial/redial
- Call progress monitoring
- Auto adjusting for touchtone or pulse phones
- Waits for dial tone before dialing
- Can be configured as COM1, COM2, or COM3
- Second telephone jack for voice communications
- Made in the U.S.A.

MCT-24I

#### \$8495



#### *Maxi-* switch *keyboard*

Everyone wants this super keyboard because it feels so good and now you can get it at JDR's great price!

- Tactile feedback
- 101 key enhanced keyboard layout
- Separate numeric & cursor keypads
- 12 function keys
- Lighted Num, Caps, Scroll lock & large Return key
- For XTs & AT compatibles

#### MAX-5339

Maxi-switch standard AT style layout.

\$64.95

MAX-5060

TERMS: Minimum order \$10.00. For shipping and handling include \$2.50 for UPS Ground and \$3.50 for UPS Air. Orders over 1 lb. and foreign orders may require additional shipping charges - please contact the sales department for the amount. CA. residents must include applicable sales lax. Prices are subject to change without notice. We are not responsible for typographical errors. We reserve the right to limit quantities and to substitute manufacturer. All merchandise subject to prior sale. A full copy of our terms is available upon request. Items pictured may only be representative.

COPYRIGHT 1988 JDR MICRODEVICES JDR Microdevices and the JDR Microdevices logo are registered trademarks of JDR Microdevices. IBM.AT.PS 2 are trademarks of International Business Machines.

## *modems*

## 2400 baud external modem \$16995

This 2400/1200/300 baud Hayes compatible modem is packed with features you'd expect to find only in higher priced models. An excellent value.

- 8 easy-to-read status LED's
- Attractive desktop design
- Adjustable volume control
- Call progress monitoring
- 2nd phone jack for voice communications
- Comprehensive user documentation
- Requires one serial port & cable (optional)

MCT-24E

1200 baud external modem

\$99.95

Hayes compatible 300/1200 baud external modem.

MCT-12E

1200 baud internal modem

\$69.95

With Mirror II communication software.

MCT-12I

95



2400 baud external modem for Macintosh \$199.95 Includes cable and ProCom-M communication software.

MCT-24EM

## pocket modem

#### **\$99**95

This take-anywhere modem is great for laptops and portables and has all the power you'd expect from a full size model. Now wherever you are, you're just a phone call away from your data. Quality design in a small package.

- 9 volt battery & AC power pack included
- Line cord included
- Switchable Bell/International protocol
- Serial interface (DB25 connector)
- 1200/300 baud operation
- 4 status indicators
- Weighs only 6 ounces
- 4 3/4" x 2 1/4" x 1"

MCT-12P

#### for Apple II computers

#### \*139<sup>95</sup>

An internal 1200/300 baud intelligent card modem for the Apple II family, now at a great price!

- Hayes compatible
- Auto answer/auto dial
- Built-in speaker with volume control



- Auto redial on busy
- Includes ProCom-A communication & word processing software

MCT-12A

MCT-24A 2400 baud version.

\$179.95

#### for the new PS/2™ computers

#### \*249<sup>95</sup>

A 2400/1200/300 baud intelligent modem and communications software for Models 50, 60 and 80 computers. Easy to install and configure using the standard IBM PS/2 configuration utility.

- Auto answer/auto dial
- Can be configured as COM1-COM7
- Includes MIRROR II communication software
- Upgradeable with 2400 enhancement option

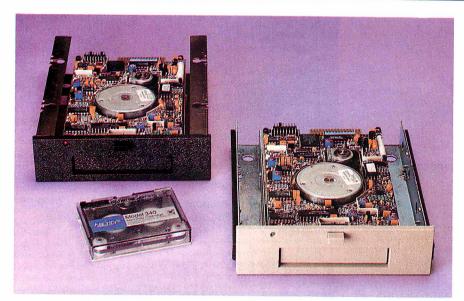
MCT-24M

#### ORDER TOLL FREE 800-538-5000

LOCAL (408) 866-6200 FAX (408) 378-8927 TELEX 171-110

## ARCHIVE® tape back-up

## \*369<sup>95</sup>



Think how long it would take to recreate your valuable hard disk data if it was accidentally erased! The Archive streaming cartridge tape drive makes backing-up easy. The AR5540A drive backs up 40 Mb in just 40 minutes. Just set it up with the easy-to-use menudriven software and come back when it's done — no more floppy swapping!

- Full & incremental back-up
- Partial & full restore
- Includes QICstream menu-driven software
- Uses standard QIC data format
- One 40Mb tape included

AR5240X — for XT and AT computers.
AR5540A — for ATs only — 2x faster.
Additional 40 Mb Tape cartridges.
AR340 \$24.95

## Seagate **SCSI drives**

#### \$399 to \$995

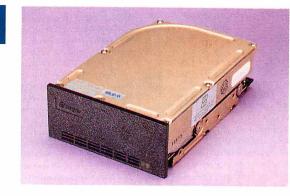
Choose from the full line of embedded SCSI drives from Seagate. This popular standard offers speed, expandability and the advantages of using a device independent bus. Compatible with a variety of systems including Macintosh, Tandy and Amiga.

			Avg.		L
Size	Model #	Mb	Speed	Price	
3 1/2"	ST-125N	21.5	40MS	\$399	
3 1/2"	ST-138N	32.2	40MS	\$399	H
3 1/2"	ST-157N	48.6	40MS	\$499	
5 1/4"	ST-225N	21.3	65MS	\$349	
5 1/4"	ST-251N	43.1	40MS	\$449	
5 1/4"	ST-277N	64.9	40MS	\$549	
5 1/4"	ST-296N	85.0	28MS	\$995	



Add SCSI flexibility to your PC! This low power, short slot card for PC compatibles can control up to two SCSI drives. Includes connector cable.

MCT-SCSI \$49.95



#### Seagate fast 40mb drive

#### \$529

The new ST-251-1 is an improved design with an average access time of 28 milliseconds — a significant speed increase over previous models. This 42 Mb MFM formatted drive fits in a regular 5 1/4" half-height bay. ST-251-1

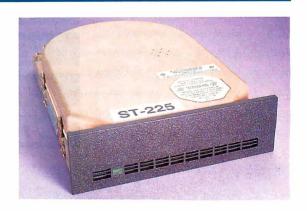
## Seagate hard disks

## \*499 60 Mb

#### was \$649—save \$150

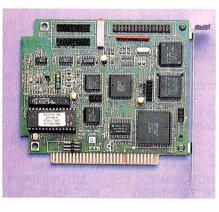
We've lowered the price of our 60 Mb RLL drive so that you can get more megabytes per dollar! Whatever your hard disk needs, we have a reliable, high quality Seagate drive at the lowest price available. Buy them alone, or with an MCT disk controller for even greater savings!

20 Mb \$225 drive only 30 Mb \$249 drive only



#### buy a controller with a hard disk for extra savings!

0:		Avg.	Drive	Packaged with MCT Controller				
Size	Model #	Speed	Alone	MCT-HDC	MCT-RLL	MCT-ATFH	MCT-ATFH-RLL	
20Mb 30Mb RLL 40Mb 60Mb RLL	ST-251	65MS 65MS 40MS 40MS	\$225 \$249 \$429 \$499	\$269  \$469 	\$299  \$549	\$339  \$539 	\$389  \$639	
80Mb	ST-4096	28MS	\$895	\$939		\$995		



#### **RLL DISK CONTROLLER**

Transfer data 50% faster! This RLL controller records and retrieves hard disk data much faster than ordinary hard disk controllers. Supports up to two RLL hard disk drives (such as the ST-238 or ST-277). Designed for XT compatibles.

MCT-RLL

\$119.95



## **MODULAR CIRCUIT TECHNOLOGY**

## disk controllers

#### FLOPPY/HARD RLL CONTROLLER

Increase hard disk performance and free up an expansion slot at the same time! This controller card combines functions normally requiring two expansion cards. It supports up to two RLL hard drives (such as the ST-238 or ST-277) for better hard disk performance, and two floppy drives (5 1/4" or 3 1/2" floppy, 360K, 720K, 1.2Mb or 1.44Mb). Designed for AT compatibles. MCT-AFH-RLL \$199.95

#### HARD DISK CONTROLLER

This versatile hard disk controller will support just about any hard disk you wish to install. It will work with 5, 10, 20, 30 and 40 megabyte drives. Designed for XT compatibles.

MCT-HDC

\$79.95

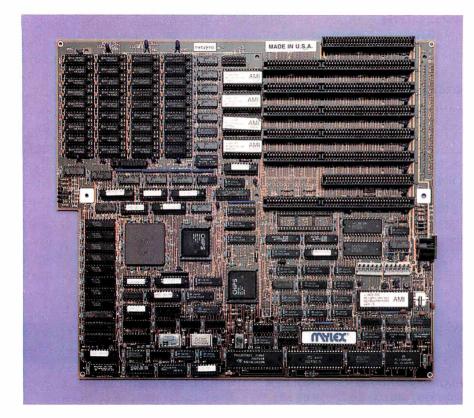
#### FLOPPY/HARD CONTROLLER

This 16-bit controller card for AT compatible computers supports up to two floppy drives (5 1/4" or 3 1/2" floppy, 360K, 720K, 1.2Mb or 1.44Mb) and two hard disks. It has a high speed (16 bit) bus to take advantage of the fast 80286 microprocessor. Includes support for disk activity LEDs.

MCT-AFH

\$149.95

# MYLEX 386 motherboards 16 MHz 1 Mb RAM \$1699 16 MHz 4 Mb RAM \$2999 20 MHz 1 Mb RAM \$2299 20 MHz 1 Mb RAM \$3599



long life lithium battery

\$1195

Install this long-lasting battery in your AT compatible or 386 computer! This 6.8V lithium battery has a longer life than ordinary batteries and is much more reliable. It's small enough to be installed virtually anywhere in your computer and it has an adhesive/velcro mounting strip and a mother-board connector for easy installation.

LITHIUM-6.8V

This well designed powerhouse represents 386 technology at its very best. With such features as high speed memory caching, a cache enabled benchmark speed of 30 MHz using the Landmark speed test (24 MHz for the 16 MHz version), near-zero wait states. and a full 32-bit motherboard throughput, the Mylex simply outclasses the competition! The 16 MHz version even leaves IBM's Model 80 and Compag's 386/16 "in the dust" (Steve Gibson, InfoWorld, Dec. 14, 1987). Its design and performance have been rated excellent by writers at InfoWorld, Computer Currents and PC Week.

- High speed 25ns static RAM in cache (45ns for 16 MHz)
- Fast operating speed (near-zero wait state)
- 1 Mb memory installed (4 Mb optional)
- 32-bit AMI BIOS provides full IBM compatibility
- 8 MHz I/O bus provides maximum card compatibility
- Socketed for an 80287 co-processor, or add an 80387 co-processor using an optional daughterboard
- Six 16-bit expansion slots, two 8-bit slots
- Fits into standard AT style case
   MCT-386MB
   MCT-386MB20
   MCT-386MB20-4

Optional daughterboard for math coprocessor. Uses one slot.

MCT-386MB-MCB

\$149.00



## **MYLEX** mini 386 motherboard

**\$1249** 

#### Landmark AT speed 23.2 MHz Norton SI 18.7

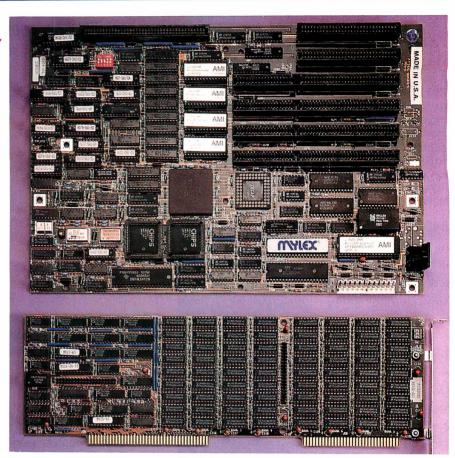
Staggering performance of a 386 in a small footprint! This motherboard uses the same cache-RAM architecture as the full size Mylex motherboards. The memory has been relocated to a 32-bit peripheral card. The memory card can provide 1 or 2Mb using 256K DRAMS (ØK installed). The on-board static RAM cache achieves higher levels of performance than you would expect from this 16 MHz 386 using 120ns DRAMS.

- 64Kb high speed direct-mapped static RAM cache
- 1 Mb or 2 Mb memory on standard memory board
- Up to 8 Mb of 32-bit-memory on piggyback memory board, for a total of 10 Mb
- AMI BIOS with 32 bit EGA support
- Socketed for 80387 math co-processor
- One 8-bit slot, four 16-bit slots, one 32-bit slot
- Dallas CMOS/Clock device on-board with battery

MCT-386JR MCT-386JR20

20 MHz version. \$1695.00 MCT-386JR-M 1 to 2 Mb memory card (required). ØK installed. \$159.00

MCT-386JR-M8 8 Mb piggyback memory board. ØK installed. \$159.00





#### tower case

**\*299**95

Save valuable desk space and add style to your office with this sleek upright design. Our new tower case has enough room for almost any configuration you can come up with and it includes an ample power supply for all your requirements.

- Accomodates all sizes of motherboards
- 250 watt power supply included
- Mounts for 3 floppy & 4 hard drives
- Turbo & Reset switch, speed display, power & disk LED's
- Mounting hardware, faceplates & speaker included

**CASE-100** 



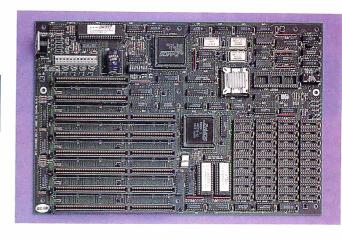
#### 

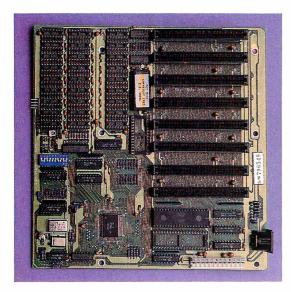
12MHz 286 motherboard

#### Landmark AT speed 13.2 MHz Norton 5I 11.6

A streamlined 80286 motherboard for your XT! This compact 286 motherboard fits standard XT compatible cases as well as "baby" AT-style and regular AT-style cases. And it has more features and better performance than a full-sized motherboard! It has three keyboard-selectable operating speeds (6MHz, 10MHz, and 12MHz), six 16-bit and two 8-bit expansion slots, 1 megabyte RAM capacity, and an automatically recharging NiCad battery. In addition, it uses Zymos POACH chips to increase motherboard reliability.

M286-12







#### **MODULAR CIRCUIT TECHNOLOGY**

10 MHz single chip 8088 motherboard

#### Landmark AT speed 4.1 MHz Norton 51 2.1

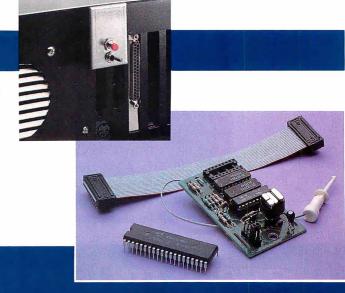
A lot of speed in a small package! This XT compatible motherboard blazes along at a fast 10 MHz — several times faster than a standard XT. It is fast enough to keep up with an IBM AT in some applications; in our own Autocad test, it drew as fast as an 8MHz AT (a math coprocessor was installed in both machines). Features include two keyboard selectable operating speeds (4.77 MHz and 10MHz), eight expansion slots and the MCT BIOS.

MCT-TURBO-10

## nickel express

Get better performance from your PC! By installing this inexpensive device, you can make your PC, XT, or clone run up to 67% faster. The Nickel Express is easy to install, requires no slot, and comes with everything necessary for installation, including a mounting bracket, cable, and software. Features include an NEC V20-8 processors, turbo switch, and three operating speeds for maximum compatibility.

**NICKEL-X** 



## intel cards

## \***895** inboard 386/pc

Get 386 performance from your PC or XT compatible! Installing this expansion card in your 8088 machine will make it run up to 10 times faster. The Intel Inboard comes with an 80386 (16 MHz) microprocessor, a socket for an 80387 coprocessor, 1 megabyte of fast 32-bit RAM, excellent documentation, disk cache software, LIM EMS emulator software, and Intel's five year warranty; at \$895.00, this is a real bargain! (An optional 2Mb piggyback memory board is also available.)

#### PCIB1200 PIGGYBACK MEMORY BOARDS

PCIB1210 1 Mb installed. \$649.00 PCIB1220 2 Mb installed. \$1195.00

#### inboard 386

#### *\*1199*

386 muscle for your AT! Boost the power of your AT or AT compatible by slipping this card into one of your expansion slots. Intel's 386/AT comes with a 16 MHz 80386 microprocessor that doubles the speed of your AT, a socket for an 80387 coprocessor, a memory capacity of 1 megabyte, a five year warranty, and superb engineering and construction. An optional 2Mb piggyback board is also available.

#### **PCIB 3000**

PIGGYBACK MEMORY BOARD

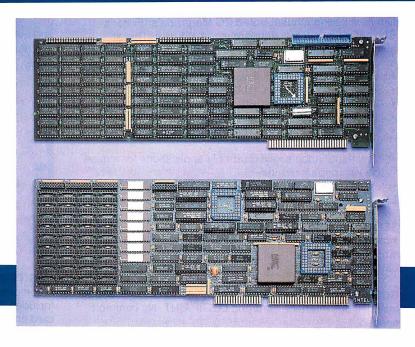
1 Mb installed, expandable to 2 Mb.

\$549.95

**PCIB 3110** 

CABLE KITS \$159.95 PCIB3001 For IBM AT.

PCIB3002 For AT compatibles.



## int<sub>e</sub>l" *math co-processors*

If you use calculation-intensive software such as Supercalc3, Lotus version 2 or Autocad, you should install a math co-processor. This will allow your programs to run from 2 to 10 times faster (your software must be designed for a co-processor). These co-processors have 80-bit floating point accuracy and trigonometric and logarithmic functions. Each co-processor comes with a comprehensive installation manual and software guide.

32-BIT COPROCESSORS

80387-16 16 MHz \$499.95

80387-20 20 MHz \$799.95



## **#LOGITECH 3 button mouse**

## \*79<sup>95</sup> to \*149<sup>95</sup>

Our best selling mouse! Voted PC Magazine's "Editor's Choice" and now the standard in the industry. This all-purpose opto-mechanical mouse is fully compatible with with most any software that supports a mouse.

All versions support the following features:

- Serial support (COM1/COM2)
- Lotus 1-2-3 compatible with software shell
- 200 dots per inch resolution
- "Click" software adjusts programs for mouse use automatically
- "Logimenu" adapts keyboard-only applications for mouse use with pop-up menus
- "Point Editor" an easy-to-use mouse-based editor

#### LMOUSE \$79.95

#### SERIAL MOUSE WITH LOGIPAINT

\$99.95

Includes LOGIPAINT — a powerful and versatile painting program.

#### LMOUSE-P

#### **BUS MOUSE WITH LOGIPAINT**

\$99.95

Includes bus interface card and LOGIPAINT. No com port needed.

#### LMOUSE-BP

#### **BUS MOUSE WITH LOGIPAINT/CAD**

\$149.95

Includes Generic Cad 3.0 with dot plot. Everything you need to turn your PC into a full CAD workstation.

#### LMOUSE-BPC



#### LOGITECH PUBLISHER MOUSE (SHOWN)

\$139.95

A complete desktop publishing package. Includes 3 button serial mouse, bus interface card and Publisher software, a sophisticated page layout program.

LMOUSE-BPBL





#### **ELOGITECH** *hirez mouse*

\*129<sup>95</sup>

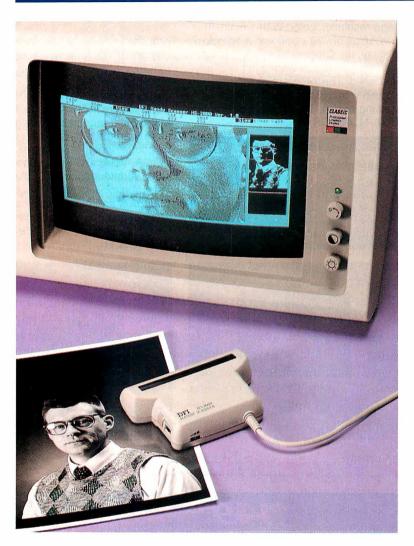
An incredibly responsive bus mouse for those who want the very best! This high resolution (320 dpi) mouse is ideal for desktop publishing and CAD programs and it requires less desk space to use.

- 320 dots-per-inch resolution
- No pad, power supply or serial port required
- Includes driver, text editor & pop-up menus
- Superb high-resolution tracking
- Bus card included
- Reliable opto-mechanical technology

#### LMOUSE-BH

## DFI handy scanner

\***249**<sup>95</sup>



The DFI Scanner HS-3000 is a hand-held scanner designed for PC compatibles that scans images up to 4.1" wide. It's so easy to use — just roll it over an image and display it on your screen — it's that simple!

- User selectable 100, 200, 300 or 400 DPI in both directions
- 2 encoding methods: B&W (High contrast) & half-tone (3 modes)
- 32 levels of gray scale
- User adjustable brightness control
- Hercules, CGA & EGA compatible
- Image editor utility permits 90° rotation & the ability to save in Windows, GEM, Halo & PC Paintbrush formats
- Includes Halo DPE, a sophisticated Desktop Publishing Editor

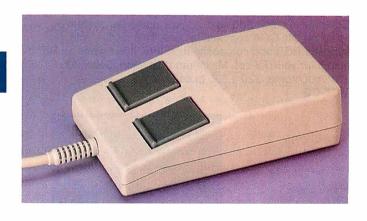
HS-3000

#### **2** button serial mouse

**\$49**95

An inexpensive but capable mouse especially useful for the economy mouse user.

- Device driver software included
- Connects to standard serial port
- Reliable, accurate opto-mechanical design LMOUSE-2



## **monitors**

**\$279**50

**\*399**<sup>95</sup>

\*599<sup>55</sup>

#### CASPER RGB

A steady performer! Whether at home or at the office, this color monitor will get the job done for you. The Casper RGB is CGA compatible and displays up to 16 colors with a maximum resolution of 640 x 200. Features include a switch to select an amber or green display (monochrome text mode), and a 14" glare-resistant screen.

#### CASPER EGA

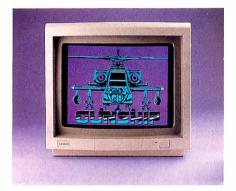
High resolution color! With a maximum resolution of 720 x 350 and a 16 color display, the Casper EGA provides you with the colors you want and the clarity you need. The 14" glare-resistant screen with a .31mm dot pitch makes viewing easier. Includes a 9-pin cable. **EGA-MONITOR** 

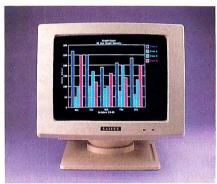
#### EGA SPECIAL SAVE \$60

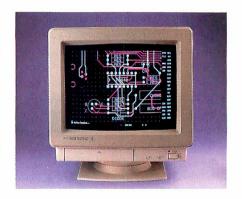
BUY THE CASPER EGA MONITOR AND THE MCT-EGA CARD TOGETHER FOR JUST \$489

#### NEC multisync II

Breathtaking color! You'll be hard pressed to find a better monitor — at any price! The Multisync II has a remarkably clear display (it has a maximum resolution of 800 x 560) with crisp, distinct colors that approach "real world" colors in VGA mode. The Multisync II automatically adjusts to the display adapter installed in your computer, whether you have the new MCGA, VGA, and PGC adapters, or the older adapters such as CGA and EGA. This monitor is ideal for CAD, CAM. Windows, and other graphics-intensive applications. Monitor includes a 9 to 15 pin adapter for use with PS/2 computers. NEC-MULTI







#### .∰\* IV

## MODULAR CIRCUIT TECHNOLOGY graphics cards

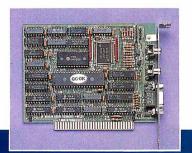
**\$49**95

\$149<sup>95</sup>

#### color graphics card

Compute in color! Add color to your computer system by installing this CGA compatible card. This display adapter supports RGB and composite monitors. It even has an RF output for your TV set. Maximum resolution: 640 x 200 in monochrome, 320 x 200 in color.

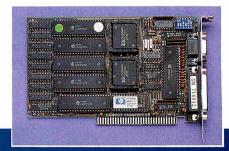
MCT-CG



#### EGA card

A necessity for the serious user! If you spend much time at your computer, you simply must have an EGA display system. This EGA card supports a 16 color display and a maximum resolution of 640 x 350 pixels. Works with EGA, RGB or high resolution monitors.

MCT-EGA



## VGA displays

## VGA package \*649°5

This VGA display system offers an unbeatable combination of color and clarity: with it, you can display a vivid array of up to 256 colors simultaneously. Other modes support 800 x 560 or the standard 640 x 480 in 16 colors from a palette of 64 colors. In addition to its color and clarity, this VGA system offers full compatibility with IBM's VGA. Consisting of a fully compatible VGA card from ATI, and a professional graphics analog monitor, the VGA system offered by JDR Microdevices is now available at a price comparable to EGA display systems.

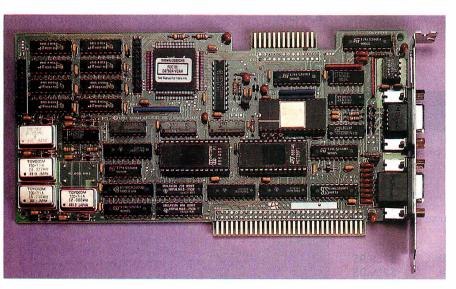
- 640 x 480 in sixteen colors for VGA compatibility
- 320 x 200 with 256 colors from a palette of 262,000
- SoftSense Automatic Mode switching for transparent downward capability with EGA, CGA, Monochrome & Hercules graphics
- High resolution, IBM style, analog monitor
- Comes with support & drivers for 1-2-3, Symphony, Windows, GEM & AutoCad
- User friendly manual with step-by-step instructions
- Software includes Mode Switching, Screen Saver & Diagnostics software

VGA-PKG



## sigma VGA graphics card

**#279**95



"... if I were in the market today for a VGA board, the Sigma VGA would be my choice."
Curtis Franklin Jr.,
BYTE, March 1988

An intelligent graphics card that offers a universal solution to the multiple PC display standards. It supports all the current IBM PC and PS/2 display modes and monitors and it's 100% hardware compatible in all modes. Ideal for use with the NEC Multisync II

- 100% register compatible
- VGA, EGA, CGA, HGC & MDA compatible
- 320 x 200 in 256 colors
- 640 x 480, 800 x 600 in 16 colors
- 80 x 25, 132 x 44 text modes
- Supports all standard digital & analog monitors (9 & 15 pin)
- Utility software included

MCT-VGA

#### *ORDER TOLL FREE 800-538-5000*

LOCAL (408) 866-6200 FAX (408) 378-8927 TELEX 171-110

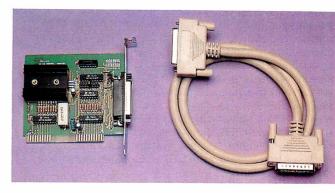
## MCT modular programmers

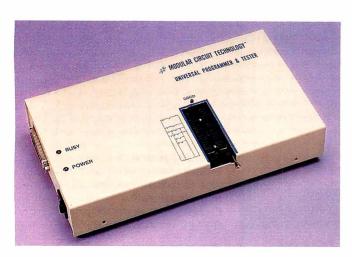
## common host adaptor card \$29°5

## Introductory offer: Order a modular programmer by October 31st 1988 and receive a host adaptor card free! A \$29ss value!

The ideal system for developers; an integrated modular design that expands as your needs grow. All the programmers require a common host adaptor card so you need just one slot to program EPROMS, PROMS, PALS, etc. The adaptor card allows user selectable programmable addresses which prevents addressing conflicts. Also included is a helpful menu driven software package which makes programming a snap! This system is comparable to equipment that previously cost thousands of dollars. Now it's available to you at a fraction of the cost! Includes molded cable.

MCT-MAC





## universal programmer and tester module

#### \*499°5

This one module replaces all the available modules at a savings of over \$430 if purchased individually.

- Programs EPROMS, EEPROMS, PALS, Bi-polar PROMS 8748 & 8751 series devices
- Load disk, Save disk, Edit, Blank check, Program, Auto, Read Master, Verify & Compare
- Textool socket accepts .3 to .6 inch wide ICs from 8-40 pins
- Tests TTL, CMOS, dynamic & static RAMS

#### MCT-MUP

#### **EPROM programmer module**

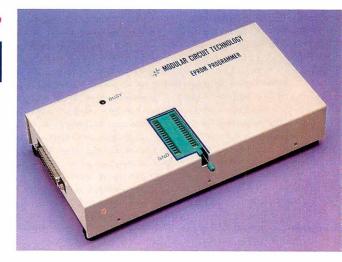
#### \*119<sup>95</sup>

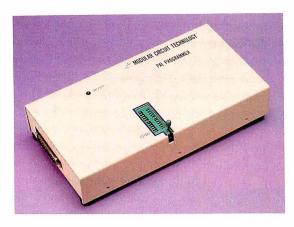
- Programs 24 to 32 pin EPROMS, CMOS EPROMS & EEPROMS from 16K to 1024K
- HEX to OBJ converter
- Auto, Blank check/Program/Verify
- Vpp 5, 12.5, 12.75, 13, 21 & 25 volts
- Normal, Intelligent, Interactive & Quick pulse programming algorithms

MCT-MEP

 MCT-MEP-4
 4 EPROM programmer
 \$169.95

 MCT-MEP-8
 8 EPROM programmer
 \$259.95





#### PAL programmer module

#### \*249<sup>95</sup>

- Programs MMI, NS, & TI 20 & 24 pin devices
- Blank check, Program, Auto, Read Master, Verify & Security fuse blow

MCT-MPL

MCT-MPL-SOFT

\$99.95

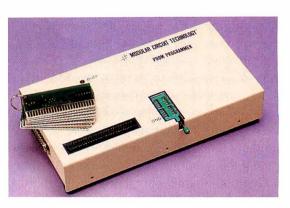
A PAL programming development software pakage.

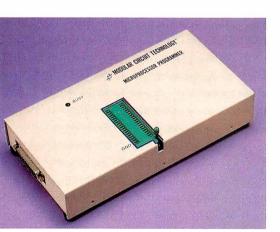
#### bi-polar PROM programmer module

#### \***259**<sup>95</sup>

- Programs AMD, MMI, NS, TI & Signetics bi-polar PROMS
  - Load disk, Save disk, Edit, Blank check, Program, Auto, Read Master & Verify
  - HEX to OBJ converter
  - Auto, Blank check/Program/Verify

MCT-MBP

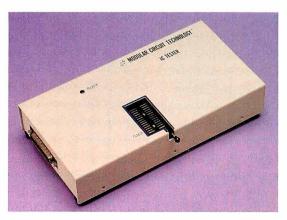




#### 8748 programmer module

#### \*179<sup>95</sup>

- Programs 8741, 8742, 8748, 8749 & 8750 EPROM & PROM types
- Load disk, Save disk, Edit, Blank check, Program, Auto, Read Master, Verify & Compare
- Normal & intelligent programming algorithms MCT-MMP



## digital IC & memory tester module

#### *\$129<sup>95</sup>*

- Tests TTL, CMOS, dynamic & static RAM
- Auto search for unknown part numbers
- TTL tester, CMOS tester, memory tester
- User-programmable test procedures

MCT-MIC

#### <u>ORDER TOLL FREE 800-538-5000</u>



# EFEJDR Microdevices<sup>®</sup> 110 KNOWLES DRIVE, LOS GATOS, CA 95030

24-wire print quality. 9-wire price.

Ho. Hum. Yawn. That's how people

react when your writing fails to keep them glued to the page. But you'll get readers' attention and keep it, when you write with appealing, fully-developed characters. Like the ones created by our Pinwriter® P2200 printer.

The P2200's 24-wire print head produces crisp, fully-formed characters for a 9-wire price. Which means you get print quality that people will stop and read. At a price that won't stop you.

Of course, stand-out print quality is just one reason the P2200 is so outstanding.

It sprints through 55 letter quality CPS

or 170 in draft mode. Dresses up memos, let-

ters, etc., with up to 128 type variations. And, like all our Pinwriters, it works with more software packages than any other 24-wire printer.

For more information about the entire Pinwriter Family, call 1-800-343-4418. And discover what a little character development can do for your writing.



NEC PRINTERS. THEY ONLY STOP WHEN YOU WANT THEM TO.



## Tandy® Computers: The broadest selection of PCs in America.



The new Tandy 5000 MC Professional System is pure performance, from the Intel® 80386 processor operating at 20 MHz to the memory cache controller that provides RAM-fast access to data.

With the 5000 MC, you have the high-performance platform needed to take the fullest advantage of industry-standard MS-DOS® applica-

tions, powerful new MS® OS/2 programs or multiuser SCO® XENIX® software.

Operating at 20 MHz, the 5000 MC cuts through the big jobs like database management, large spreadsheets and sophisticated graphics. Its IBM® Micro Channel™ compatible architecture allows multiple processors to use the same bus.

The system architecture also provides a radical increase in data-transfer rates when the Tandy 5000 MC is configured within a 3Com® workgroup or a multiuser environment.

The Tandy 5000 MC is the new alternative in personal computing—from the best-selling family of PC Compatibles made in America.

Tandy Computers: Because there is no better value.™

Intel/Reg. TM Intel Corp. IBM/Reg. TM and Micro Channel/TM IBM Corp. MS, MS-DOS and XENIX/Reg. TM Microsoft Corp. SCO/Reg. TM The Santa Cruz Operation. 3Com/Reg. TM 3Com Corp.

Radio Shack

COMPUTER CENTERS

A DIVISION OF TANDY CORPORATION

Circle 225 on Reader Service Card